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December 1, 1924

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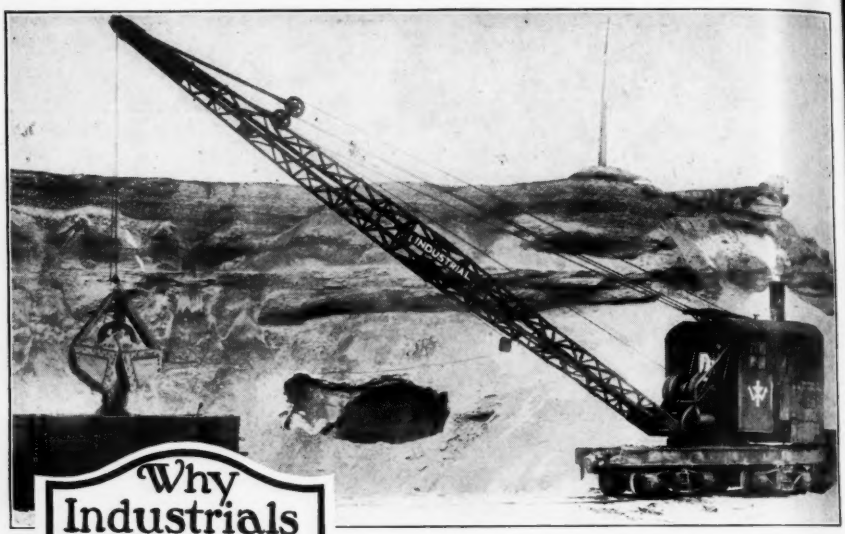

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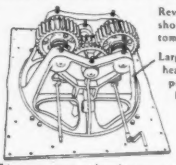

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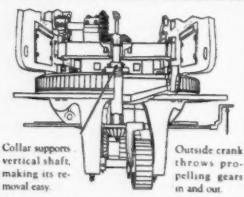

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Pit and Quarry

A Semi-Monthly Publication for Producers and Manufacturers of Sand, Gravel, Stone, Cement, Gypsum, Lime and Other Non-Metallic Minerals.

VOL. 9 CHICAGO, ILL., DECEMBER 1, 1924 NO. 5

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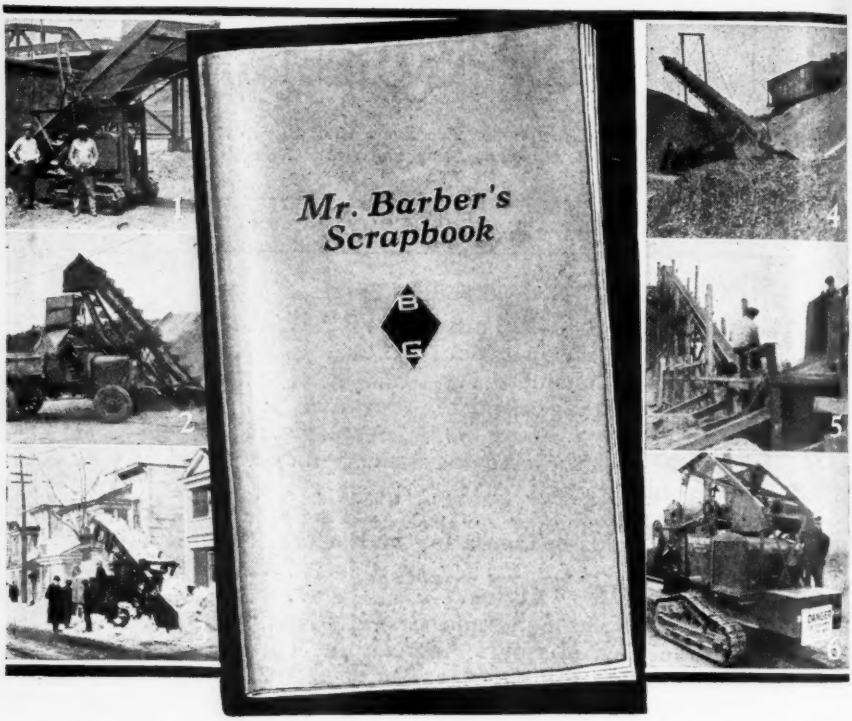

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Pit and Quarry

Vol. 9 Chicago, Ill., December 1, 1924 No. 5

The Moderate Sized Plant

THERE are some advantages that the moderate sized or small plant have in comparison to the large plant. These advantages are even more pronounced if compared to the operations of a large producer who has several large plants.

Where quantity production is not essential and quality is important the small plant is able to utilize these advantages to the extent of competing successfully with any legitimate competition. The advantages of the larger producer lie chiefly in sales and purchases. He can generally reach a wide market. When competition becomes too keen in the local market, it is possible for him to reach out to a market where he can successfully compete.

In general the actual manager of the small plant are the owners with a vital and active interest in the plant operations. They are able to act quickly on matters presenting themselves daily and adjust their policies more quickly to fit conditions.

The influence of a magnetic personality at the head of operations will reach the entire force without having to filter through a set of officials. The small plant should have less labor trouble.

The operations of the small producer are usually concerned with one plant. Direct personal contact may then govern. The red tape and internal correspondence which is usually found necessary in the organization of the large producer, is unnecessary in the small plant. The overhead in the smaller plant is usually less in proportion than the larger plant.

Increasing growth generally necessitates some sacrifice from all of these advantages. Increasing the size of the organization alone actually weakens the company unless it brings compensating advantages.

The smaller plant is subject, however, to contingencies and emergencies to a greater degree than a large plant. The small plant might have profitable and apparently desirable connections, but, unless these connections are protected and in a sense guarded against, they may place the small plant at the mercy of an outside interest. Many small plants make promises for delivery which can be filled only by an endless succession of rush orders. The desire for every small plant to grow brings problems. Growth depends on wise forethought and provision for extension of both plant and organization. Provisions for physical growth are generally more thought out than provisions for the development of the organization. At the time the plant is built, duplicate units of machinery are frequently allowed for as are also provisions for additional units. But the personnel of the small plant is not often chosen with growth in mind. The large plant can get and pay for a big man who has already demonstrated his ability and power. The small plant must develop him. The small plant which selects, trains and coordinates its force into a smooth working unit is building an asset which gives it an advantage over any competition.

The small plant has two problems to consider in physical growth. Shortsightedness, inaction, poor methods result in the inability to develop new business. Over expansion, however, invites disaster. Over expansion is the more general tendency. The ratio between the "danger point" and the capacity of the plant should be watched. This "danger point" is where the volume of business is sufficient to carry the fixed charges and variable expenses and beyond which there is a profit. If this danger point is low with respect to the plant capacity, the business can fluctuate considerably and still show a profit. If the danger point bears a high ratio to the plant capacity a comparatively

slight decrease in the volume of business will quickly show a loss. When this ratio is 50 per cent or lower the business is on a sound basis.

Many small plants are in a transition stage. Future growth generally involves the substitution of new methods. Most small plants need an accurate knowledge of costs. A system of accurate production and selling costs should be tied in with the financial accounting. A definite plan with relation to sales and production is also necessary. The various methods of material and production control should have the attention of every small operator. These facts if analyzed in the light of the individual conditions may easily affect the profits of the small operator.

Competition or Cooperation

WHETHER we recognize it or not, we are rapidly drifting from competition. There is no concerted plan except for a few who are far sighted enough to steer their own operations, as much as they can, in the current in which we are all being carried along.

The old problem of "how to keep on operating when competitors are making price concessions to secure business" is rapidly disappearing. Producers today go into the market maintaining a price that will afford a profit to the vast majority. The competition is usually a matter of quick careful and thorough service. The fact that the operator assures himself a profit through cooperation should by no means lessen his desire for further profits which may be had by cutting costs of production. Most operators can see the profits of cooperation but fail to see the profits of competition which can be had by competing in the economies of production. The two however will bring greater profits. Trade associations, cost figures, modern improved methods of production, publicity of problems, methods and their solution have all helped.

Of these factors, publicity has contributed a great deal. This is the age of publicity. Trade and manufacturing secrets belong to the past. Today we have our associations where recommendations as to the best and most economical methods of operation are discussed. The old problem has been replaced by a new one. Now it is a question of keeping pace with progress. Producers owe it to themselves and to the industry in which they are engaged to join these associations and support them wherever possible.

The great danger to cooperation lies in its abuse and consequent government interference. There are producers who cannot restrain themselves from running up prices as far as the traffic will permit without a thought of the future. It is a policy to "get while the getting is good." The consumer stands for a certain amount of extortion and then he yells for restrictions. Government restrictions usually cost out of all proportion to the benefits gained. Whether restrictions on prices can be controlled effectively by trade associations under existing laws is a question. If they can be maintained at a reasonable rate the advantage will be great otherwise the consumers who constitute a group constantly increasing in size and power will appeal to the lawmakers. These lawmakers having due respect for the size of this group of consumers will enact laws for price control.

A Program to Consider

1. Control production with a thought for eliminating lost time.
2. Balance the productive capacity of your plant with the demand for the product.
3. Coordinate your financial plan with production and sales.
4. Use a budget plan.
5. Adopt a uniform accounting system.
6. Watch your current assets.
7. Eliminate cancellations.
8. Centralize your business efforts.
9. Encourage healthy expansion but avoid shortage of capital from outside investments or sidelines.
10. Utilize all possible sources of capital.
11. Inspect equipment regularly and adequately.
12. Maintain the plant and equipment in first class working condition.
13. Provide duplicate units wherever necessary and economical.
14. Devise a store room record for equipment in stock and check out all material drawn from store room.
15. Encourage industrial research in your trade association.

Institutional Management of Workmen

Written Expressly for PIT AND QUARRY by D. J. Hauer

INSTITUTIONAL management of workmen has been defined as handling men so that they are satisfied with their work and rate of compensation and also feel that they and their fellow workmen, together with their employers make up an organization that will become an institution, that will continue for years and be independent of any one man, even the man who conceived the organization and built it into an institution.

Very recently the writer attended the anniversary exercises to celebrate the fifty years of an institution's existence. This institution has been a great success so that it stands out above most others of its kind. The fact is that many other similar institutions have been modeled after it. The writer was struck with one significant fact that was brought out by all the speakers of the occasion, and more especially by the present head of the organization. He stressed the fact that every one connected with the institution during the fifty years had caught the spirit of the founder and had put forth his best effort, enduring hardships and making sacrifices for the benefit of the institution. Many employees had spent their lives in working for this institution even men and women who had occupied menial positions. He declared the same spirit pervaded the organization today. Those that held positions were never anxious to give them up.

The same principles are applicable to the stone, sand and gravel industry, not only those located near or in large cities but likewise at pits and quarries that are isolated and have a community of their own. A number of articles on the various phases of this subject have appeared in this journal during the past two years, and those interested can look them up in their files, for each article has treated of different features that go with handling men successfully. It should be the endeavor of every quarry operator to hold the same men in his quarry for a long term of years; for the changing of men means additional cost in teaching and training them. This fact is not always realized, for the cost of changing only a few men does not always appear. It is realized when a large number of men are changed; when the production drops off and the costs increase.

If men are made to realize that they are part of an institution and may have something to say as to the management, they will cease to look upon their work as only a temporary job and will come to realize that they have taken up their life's work. When this occurs, an operator will realize that he has made a success of his management, and he has an institution that will give him and his employees a living for a long term of years.

The late H. L. Gantt, who was the originator of the bonus system of rewarding workmen, has written much on the basis of paying men, showing that an industry or a business is to a limited extent a cooperative organization. Capital must have the assistance of labor to earn money, while the labor is almost helpless without being aided by capital. Keeping these facts in mind Mr. Gantt reasons that there should always be an equitable distribution of the earning of an organization. The day of grinding men down to a starvation wage is past, and no business can prosper or live long that pursues such a policy. Nor is it possible today for a capitalist to succeed if he attempts to keep for himself all the profits of the organization. It is very true that capital must have an adequate return for the money invested. It is generally conceded under modern bookkeeping and accounting that before profits have been figured, there must be credited the interest on the money invested, and depreciation charged against plant and certain allowance made for renewals and other overheaded expenses. When this is done, those who have furnished the capital are entitled to a good wage and a dividend on their investment, and beyond this the wage earners are entitled to the rest of the profits.

In general terms these were the underlying principles laid down by Gantt, and he was able to put them into practice for a large number of

progressive manufacturing establishments, all of which under his supervision prospered beyond the expectation of those interested. Although Gantt is dead, his work is his monument, and in years to come thousands will be benefited by the principles he laid down.

A man of vision and with ambition can not be held long for an ordinary wage. He must see something for the future, something more than an ordinary living. Mr. Charles M. Schwab, when he worked for Andrew Carnegie, was paid a million dollars a year, and when Carnegie was asked regarding this he is quoted as saying, "The million dollars a year I pay Charlie Schwab is the most profitable money I pay out in my business, and some day Charlie will be earning more than that, if he keeps developing as I think he will. I find I cannot afford to pay men anything but good wages. You see most men refuse to give their juniors a real chance to show their ability. I make my juniors use their brains. I crowd responsibility upon a man as quick as he can take it. The more I pay him, up to his worth, the more profits he earns for me."

The late Andrew Carnegie was a far seeing and successful business man, who did not deal in theories but in actual conditions. He built up a business of such large proportion that he dominated his entire industry, and became a world known master of business. Mr. Schwab, who was trained under him, has continued Carnegie's policy of handling men; and he has surrounded himself, as did Carnegie, with many able assistants, who are considered top notchers, and who are earning many hundred thousand dollars a year. This shows that the principles that were laid down by Carnegie were not only applicable to his own handling of men, but others have found these principles to be correct.

Naturally such treatment of men binds them to the employer. Mr. B. A. Franklin who is the originator of the idea of institutional management holds that men must be treated well both while at work and during the hours of their leisure and that the man's family must be considered as well as the workmen. This reverts to the compensation of men, for if a man is held down, especially in his pay, his family becomes dissatisfied, and if his wife feels that their income is too small and that the head of the family is not being paid what he is worth, this man will seek other employment. The only way to develop a man is to throw responsibility upon him, and if he cannot assume these responsibilities, he is the wrong man for the place. A man feeding a crusher, if he is to be successful, must be given to understand that the entire responsibility of the output of the crusher is dependent upon him, and he must see not only that the crusher is run to its full capacity when stone is being fed into it, but that stone is also delivered to the crusher so that it will operate without interruption. A man who can secure a thousand tons a day from a crusher by seeing that it is fed properly, is certainly worth more than a man who secures only five hundred from the same crusher. Ordinary wages may be all right for the last man, but the first man is a top notcher and should be paid accordingly. This is the way to handle every man, whether he is a dollar a day workman or a hundred dollars a day manager. No employer can afford to pay a man a salary if he is not making a profit off the man's work. Therefore the more profit that is made off a man, the larger should be his compensation. No man can make large earnings who is handicapped by too many restrictions, such as rules and regulations, or too much bossing. Under such conditions he feels that his responsibilities are lifted. A man can do his best work only when he is unhampered and feels that the responsibility for results is up to him entirely. Most employers and managers make the mistake of doing too much bossing and interfering too much with the way men do their work. A manager must only look for results and must at times be blind to mistakes that are made.

Every one will make mistakes, and although some men can be forewarned against certain errors, yet the majority of people must learn from their own experience. No matter how much experience a man may have he will still make some missteps; but if a man is allowed to shoulder responsibility when he is young, as he grows older he will be free from serious mistakes and his earnings for his employer will be large.

This is illustrated by the example of a man with whom the writer worked for many years. This man once applied for a job as superintendent and was told that he would

be employed. Then the question of wages was discussed and he asked for a salary of six hundred dollars a month. His new employer was surprised and said that he could obtain plenty of superintendents for three hundred a month. The new superintendent's reply was that this was very true and that some men could be employed for even less than three hundred, but that these men had much to learn and the employer would pay more than the difference between their salaries and the salary he wanted, for the mistakes that they would make. He further stated that it had cost his former employers many thousands of dollars to educate him, and that he was bringing to his new employer the knowledge and ability that other people had paid for, in his training. He secured the job and the results were as the superintendent stated that they would be. Such a man may make some slight mistakes, but he does not make too many serious ones.

Institutional management retains good men in the employ of the organization and gets rid of men who are below the average, or else retains them only in subordinate positions. The idea is not only to hold good men, but to make them want to retain their positions and to have them feel that the organization is as much theirs as it is that of the man that has his money invested. Thus it can be seen that institutional management does not permit of men being discharged for minor offenses or for making mistakes. It costs much money to train men and to have them accept responsibility, and to discharge a man means to throw away the money that has been expended to train him and which has bought the experience that will prevent him from making mistakes in the future. A man thus discharged will carry to his new employer, a competitor, the fruits for which his first employer paid. It has been stated that no employer has money enough to permit him to discharge a man of experience that he has trained. Few employers seem to realize these facts and yet one who makes a study of these things will soon build up an institution that will not only net him large profits but give his employees an unusual compensation for their endeavors.

Some masters of industries who will recognize the facts that are set forth here also believe in strengthening their organization by buying men who have proved their ability elsewhere. In other words men who are making money for others are employed at a higher rate of compensation and thus the organization profits from the money spent by others to train these men, while new ideas are brought to the organization. This method works well in some cases, while in others it causes friction between the old and new men which it is difficult to overcome. Then too this procedure can kill the ambition of the men who are already in the organization, who feel that their incentive to put forth their best effort is of no avail if outside men are given the best places in the organization. Thus to bring in new men great care and judgment must be exercised to prevent injury to the business.

The endeavor of every employer should be to make his men feel that they are his partners. Ordinarily this word means that every man has either invested money in the business or if it is a stock company that he is a stockholder. The word is not used with this particular meaning in mind, but rather in a broader sense that each man in the organization shares responsibilities with the owners, and is to receive a share of the profits according to the worth of his labors or the money that he has invested in the organization. Where men feel that they are partners in this sense of the word, the organization has become an institution, and an employee would no more think of severing his connection with the institution, than the principal stockholder would consider withdrawing his money.

Where men are given responsibility in an institution of this kind, this responsibility must go further than to apply to a man's own particular work. He must feel that there is a certain responsibility on him for the entire organization and that he is interested in other departments besides his own. This can be accomplished through a committee or board of advisers made up of representatives of the employees and employers. Such a board can cement capital and labor together as is done by no other means. It is a clearing house for all ideas that may originate with any member of the organization. Indeed this board can offer incentives to every one to think and work, to strengthen the organiza-

tion, to increase production and obtain larger sales. The poorest workman can sometimes show an improved way of doing work, and he will talk to a fellow employee, when he will not to the boss. It is ideas that can be gleaned in this manner that will add materially to the season's profit. The writer has seen many cases, where workmen, who were given the proper incentive, suggested that some of the men be taken from their crew, thus adding to their own work in order to put these extra men at some profitable work. This has been the case with men using picks and shovels as well as mechanics and others who were doing a higher class of work. It is done on the principle of securing the greater good of the largest number. However, men expect to be recompensed for these ideas and the extra exertion they put forth.

Such a board of advisors can prevent strikes and adjust wages. It is through a board of this kind that a bonus system for rewarding workmen can be used, and an increased profit can be made and that arrangements can be devised for the employees to share in these extra profits.

The pit and quarry business is considered a hazardous one, and one thing that a board of advisors can do is to prevent accidents and possible injuries to men. They can show where safeguards are needed and from time to time make inspection of the plant to see that everything is in order and that men are not becoming careless. Another great value of this board is to see that the proper care is given to machines so that they are kept in working order so as to prevent breakdowns and delays. This alone can mean increased production and additional profits earned. It also means that machines will last longer and that the proper attention will be given to the purchasing of new devices that can cheapen production.

The board of advisors can also look after the welfare of the men. This may take some form of insurance against sickness and death, through a regular insurance company or a relief and benefit association. These features are appealing more and more to the American workman and an organization is greatly benefited by the proper care of men along these lines.

The welfare work that can be done through such a board, covers a wide field. The proper housing of men should always have consideration, for employees should be given comfortable homes with the proper sanitary surroundings, and these should include proper supplies of food. Men cannot work well if they do not live well. A happy home must be behind a satisfied workman. The writer has known of serious accidents from blasting due entirely to trouble in men's homes.

If men are not living close to their work, then means of transporting men from their homes to their work must be provided, for an organization is quickly broken up if men are late for their work or they begin their day's labor after tiring themselves out. These things are all work for the board of advisors.

Then too there must be amusement for men and their families. Today this has taken on various forms in different institutions. There are ball and athletic teams that can be organized and ground furnished for their use. These can be the means of advertising the organization. Social events and dances can be held and money thus raised through them to help in other social work. Lectures can be held and moving pictures furnished, and this work can be even carried into the religious field, if this is deemed advisable.

One thing that must not be overlooked by a board of advisors is the education of the employees' children. School arrangements must be made and if these are not close at hand, transportation facilities must be provided to get the children to the school.

These are the essential features of institutional management, and an employer who works to the end that his organization becomes an institution along these lines will build up his business. He cannot secure all the results within a short time, but he can commence at once and build gradually upon a firm foundation.

The Ridge Sand & Gravel Company of Rochester, New York, was recently incorporated for $10,000 by H. D. and M. E. Hutcheson.

The Reliance Rock Co. of Glendora, Calif., has begun construction of a large rock crusher near Azuza, which will be ready for work December 1.

The Standard Portland Cement Co. of Moundsville, W. Va., has been incorporated for $150,000 by D. B. Evans, S. B. Wilson, J. B. Dorsey and J. B. Wilson.

The Western Pennsylvania Sand & Gravel Co., Pittsburgh, was incorporated for $5,000 by George H. Flinn, A. Rex Flinn, and M. J. Feeney.

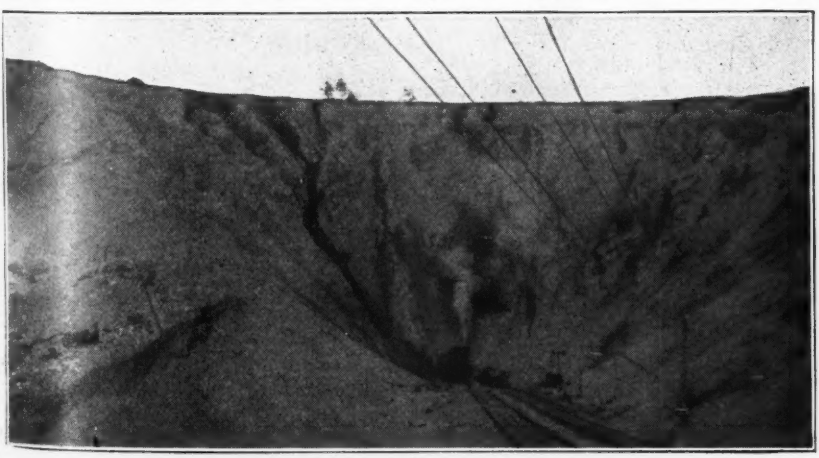
Pioneer Sand and Gravel Company Solves Some Problems

Peculiar Methods of Sluicing Adopted to Fit Conditions Distributing 15,000 Yards Daily from Seattle, Washington

THE Pioneer Sand and Gravel Company, Incorporated, operating out of Seattle, is the principal distributor of sand and gravel in the State of Washington. Their supply comes from two banks and one river deposit. Their largest operation is at Pioneer Pit, situated on Puget Sound about 28 miles from Seattle, near the town of Steilacoom.

The deposit is of glacial origin, supposedly the head of the great morane from Mount Ranier. At the site of Pioneer Pit this deposit rises from the sound on a 45 degree slope to an elevation of 240 feet above low water. The top 18 inches is black soil, under which is a horizontal layer, dropping down to an elevation of 200 feet, of well graded sand and gravel. The material below the 200-foot elevation is heavily stratified dipping toward the bay at an angle of approximately 35 degrees with the horizontal. Some of these strata are 40 feet thick of pure gravel from ½ inch to 3 inches in diameter and are absolutely devoid of sand. Other strata are of pure sand and some are a very good mixture of sand and gravel. The high bank has made it possible to operate this deposit hydraulically, and the stratification has made it necessary to adopt a peculiar method of sluicing.

In the early days of the development of this plant it was customary to build a bunker of about 1,000 yards capacity and sluice the material to it. As the hill pitched sharply into the bay, the bunker was built on piling and no provision was allowed for storage. The excess of any particular material above customers' orders was dumped into the bay as waste. In this way about 1,000,000 yards were taken out to a set up at an economical cost. Then another bunker would be built a little farther down the bay; the pumps were moved and the old bunker abandoned. This method worked well enough when the quantity of material shipped was small and when a set up would last five or six years. But the demand for Pioneer material has grown very rapidly. The Northern Pacific and the Union Pacific Railroads have built main lines through the property against the toe of the slope and shoved the bunkers over a hundred feet farther into the water with a resulting lessening of the bank available for sluicing. It thus became evident that a modification of a strictly hydraulic operation had to be devel-



Shovel Working Against 150-Foot Bank.

A Partial View of Sluicing Operations.

oped. This is being undertaken at the present time.

The present set up consists of two scow bunkers and two rail bunkers with capacities of 2,400 and 600 yards respectively. The same set up existed three years ago at the time it was decided that the bank available for sluicing into these bunkers had been worked out. The bunkers were still in good condition, and all the plant equipment was concentrated about them. To build new bunkers would have involved quite an expense and would only have hastened the day when it would have been necessary to elevate the material. So it was decided to clean up the old sluicing level to the elevation of the docks. They also figured that this would give considerable space that could be used for storage room for the seasonal excess of material such as fine gravel in the summer and coarse gravel in the winter. When needed this material could be reclaimed and in this manner the waste would be cut down considerably.

For elevating the material three hoists were installed because they wanted to keep a large area opened up where they might have some leeway in selecting material to meet the demand and to guard against delays from breakdowns. Two of the hoists are semi-automatic, 135 H.P. electric. The third is a manually controlled 200 H.P. electric. The first two elevate from hoppers set in about 300 feet from the original face of the pit and just enough above the tide water to allow for drainage. The 200 H.P. hoist elevates from a steam shovel 1,000 feet from the beach digging down to tide water.

The sluicing to the hoppers is identical in operation to that formerly employed throughout the pit. On account of the peculiar stratification of the pit, they do not use one large giant feeding flume for the reason that the water will not flow across

Six-Yard Skip Car Dumping Onto Scow.

the heavy strata of gravel but disappears the instant it reaches the loose gravel. For that reason they take off from the main pipe line laterals of 6 inch slip joint pipe which terminate in heads having two or three outlets. To each outlet is fitted a 50 foot section of 2½ inch fire hose. The discharge end of this hose is provided with a nozzle made by inserting a 12 inch piece of 2 inch pipe, reamed out at both ends. The flumes are built of 4 foot sections, the main flumes being 14 inches wide made up of 2 inch x 14 inches S4S bottoms and 1 inch x 12 inches rough sides. The lateral flumes are of the same construction, but 12 inches wide. In starting a flume a section is dug into the bank and set on a 12½ per cent grade. The sides flush to the top of the box are tamped in with sand. Two hose, one on either side of the flume, are set so that their water will discharge on the material to the side of and near the end of the box, if sluicing in gravel carrying considerable sand. If sluicing straight gravel, the hose are generally set so that they play on the material in the box, the material being brought to the box by playing the stream on the bank for a few moments. When the bank will no longer slide into the box the material is washed out for 4 feet immediately in front of the box with as little disturbance to the standing bank as possible. A box is then hastily placed and tamped, the bank poled for another slide and the process repeated. A good sluicer, by watching his work, will lose very little water in coarse gravel. When sluicing in sand there is hardly any loss. The third hose is used when straight gravel is encountered and is pointed in the direction of the flow of material and acts as a chaser. The flumes are kept plated with chrome steel ½ inch x 12 inches right up to the bank. When straight coarse gravel is sluiced, it is hard to move even on the plates and the heavy grade. A 50 foot section of hose is used to make it possible to get over more ground with one flume, and also to give the sluicer a chance to get away from slides.

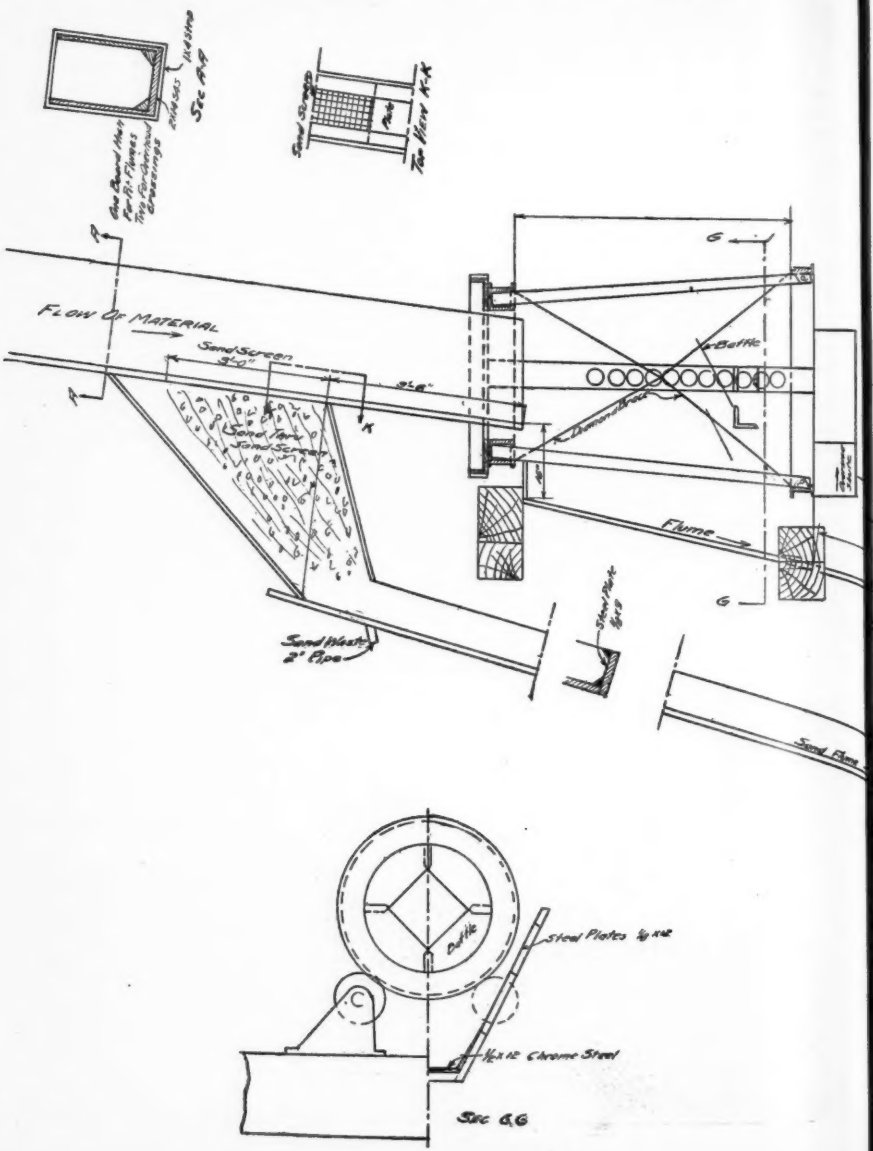
The hoppers are fed by three flumes each capable of carrying 50 yards per hour. The hopper is divided into 12 bins, four to the flume, which serve as settling or dewatering tanks. A man stationed on top of the hopper fills the proper bins and signals to the loader underneath as to the proper bin to empty.

Two cars tied together, with a haul back on a double track, are used at number 1 hopper. The cars are 4 yards capacity of the side dump type and are drawn up a 45 per cent slope to the dumping ramp on the old sluicing floor by an automatic hoist. This dump has a storage capacity of only a hundred yards as the material is sluiced to the bunkers as quickly as it is hoisted. The small storage is provided to take care of short interruption in the operation. The opera-

Sluicing From the Shovel Dump.

tion of the hoist is automatic throughout except for the loading of the cars. When the car comes under the proper bin of the hopper, the loader pulls a switch opening the operating coil on the primary closing jack of the motor. When he has the car loaded, he closes this switch. The car starts out slowly, picking up speed as the master switch on the motor cuts out the secondary resistance. When it reaches the ramp, the master switch cuts in resistance and slows down the car as it dumps. At the end of its travel, it trips a reversing switch which reverses the motor and starts the car back again.

The other automatic hoist lifts from a number 2 hole, which is an operation identical to number 1 hole except that a 6 yard skip car dumps on a ramp with about 200 yards of



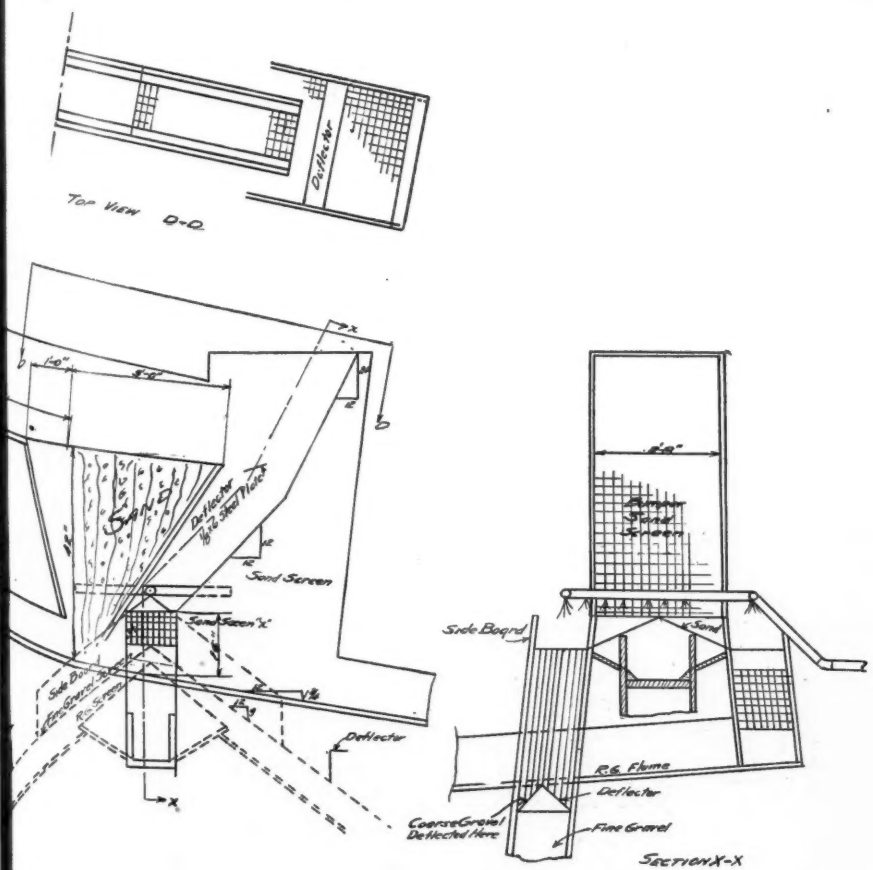
storage. Third hoist takes care of the output of the steam shovel. The hoist is manually operated and is a two drum arrangement handling two 10 yard side dump cars on a double track system dumping on a 50 foot trestle to an 8,000 yard stock pile on the old sluicing floor.

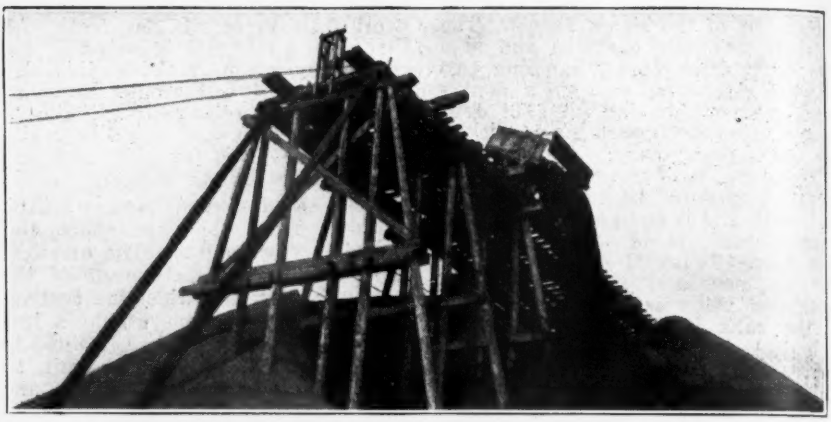
The shovel is of the full circle type mounted on standard railroad wheels and track and is equipped with a two yard dipper. It is working a 150 foot face. To avoid slides and danger to men and shovel, a small stream of water is run over the top of the bank in front of the shovel. This keeps the slope flattened out and easily keeps the shovel in material. This shovel working eight hours per day will average 1,600 yards per shift every day in the month.

From the two automatic hoists and shovel dumps the material is sluiced to the railway and scow bunkers, an average distance of 300 feet. Although the material is naturally exceptionally clean, sluicing this distance gives it a thorough scouring, and if there were any dirt clinging to the sand or gravel, it would be pretty well scrubbed off by the time the material reached the bunker.

The method of separation is a little different from that commonly employed in most plants. The arrangement used is a direct result of the hydraulic operation when the controlling factor has been elevation. A loss of one inch on the bunker resulted in a loss of 1,000 yards in the pit, so the bunker was built low, short and squatty with minimum clearance and not too much capacity.

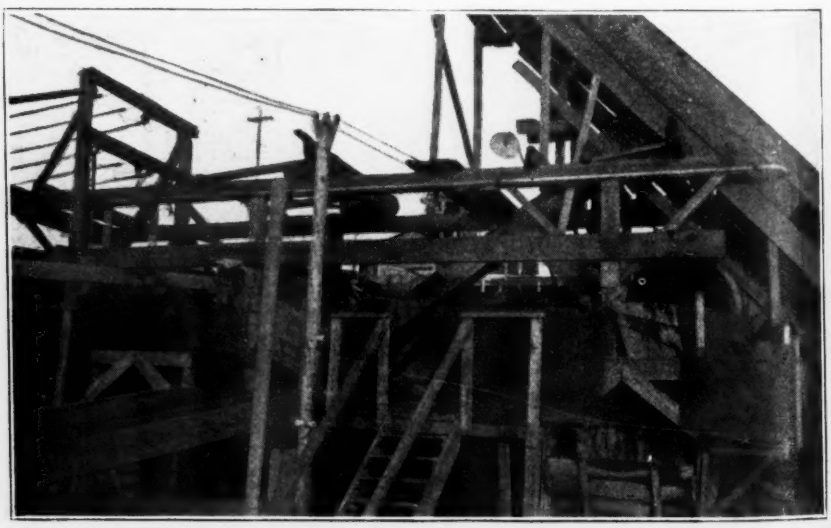
The material, upon reaching the bunker above section A-A (see dia-





Ten Yard Dump Car Unloading To Incline Storage.

gram) passes over a sand screen in the bottom of the flume shown in section K-K where part of the sand is taken out. It next enters the revolving grizzley, a front view of which is shown in section C-C. The rejects pass down the oversize chute to the crusher and are returned to the flume under the grizzley. Just before the material hits the main bumper sand screen, it passes over another sand screen in the bottom of the flume where more sand is removed. The remainder of the sand is taken out on the bumper screen and deflector screen "X." Screen "X" serves to split the gravel to either side of the separator where it is again split over a hip screen which removes the fine gravel. The coarse gravel rolls off the fine gravel screen to the coarse gravel bins directly under the separator. The roofing gravel is removed from the fine gravel directly underneath the fine gravel screens. The fine gravel is chuted to bins to either side of the coarse gravel. The roofing gravel is flumed away to bins at the side of the bunker, and the sand is carried to settling boxes where paving and building sand are recovered by a gravity separation. The grizzley used is manufactured by the Washington Iron Works of Seat-



Three Revolving Grizzlies On No. 2 Bunker.

tle and is a very efficient piece of equipment for this work. The separation on the rail bunkers is similar to that on the scow bunker.

To some producers this screening arrangement might appear to be a makeshift. However, it produces a well graded product at a minimum cost for upkeep and delays for repairs.

Material can easily be made to a certain specification. It is a simple matter to meet the varying demands of the specification inspectors by either changing the inclination of the screens or cutting in or out short sections. This is done in a few minutes and at little cost. One man is used on each bunker, and he looks after three separators which produce 150 yards per hour.

Two six yard skip cars are used for each bunker for loading the scows. The cars operate on four tracks under the bunker, which converge to two at the tipple. The cars are loaded through sliding doors under the bunker, four 12 inch x 12 inch doors per car, and are operated by a double drum steam hoist. With both hoists running 800 yards per hour can be loaded.

The water for sluicing is furnished by two double volute 14 inch Cameron pumps, in series, pumping against a head of 160 feet, with a capacity of 5600 gallons per minute. To take care of this peak demand they have in reserve three old steam pumps with a capacity of 2500 gallons per minute, which were in use before electricity was available.

Pioneer Pit has a capacity of 10,000 yards per 24 hour day. It produces all grades of commercial sand and gravel except plaster sand, which is produced at the Central Pit near Seattle. It also produces both pit run and washed ballast for railroad use and ship ballast.

The company operates four distributing bunkers in the city of Seattle. All the material moves to these bunkers by scow from which it is unloaded by clamshell buckets. The Spokane Street bunker is a new site and under construction. Temporarily the material is being handled by a floating derrick operating a clam shell bucket to five small hoppers. A warehouse, bunker and storage yard for 6,000 yards are now being built. When this set up is complete, the material will be unloaded from the scows with a Link Belt crane using a clam shell bucket.

At Westlake a stationary electric still leg operates a two yard bucket to bunkers of 600 yards capacity. At Latona an electric stiff leg derrick traveling on top of a 600 yard bunker unloads the material. At Rainier Beach the company operates a regular Stephens Adamson washing plant with conical screens and automatic Link Belt sand settling tanks, except that the material to be washed is brought to the bunker on scows from Cedar River, some 10 miles away, and is elevated to a hopper on top of

Thirty Going Out and Thirty Coming In.

the bunker by a Gantry crane handling a clamshell bucket. The hopper is equipped with a reciprocation slide gate to supply the two sets of conical screens with a steady feed.

Central Pit has a capacity of 1,500 yards per 24 hour day and is operated principally for plaster sand. The bank at Central is 165 feet high and runs heavy to sand. It is also worked by the hydraulic method. On account of the compact formation they use a giant and one large flume dividing at the bunker into two flumes. The bunker has two separators of the stationary inclined screen type. Blaw Know buckets are used in all operations.

The Pioneer Sand and Gravel Company operates seven scows of their own, five of them being of 400 yard capacity, and two of 700 yard capacity. About 50 per cent of the output of the pits is handled by foreign scows provided by contractors letting out their own towing. The company ships by water within a radius of 200 miles and four to five hundred miles by rail. The long train haul is accounted for by the exceptionally high quality of Pioneer Pit material and the difficulty of obtaining good sand and gravel inland. Of the material handled by the company about 70 per cent comes from Pioneer Pit, 15 per cent from Central Pit, 8 per cent from Rainier Beach and 7 per cent from other sources.

Mr. H. F. Ostrander is president of the company, Mr. D. L. Williams, manager, and Mr. Paul Jarvis, superintendent of Pioneer and Central Pits.

Boiler Notes

There are two methods of firing coal into the fire box. One is known as the spreading and the other as the coking. The spreading method is adaptable for anthracite coal and for bituminous and consists in spreading the fuel evenly over the fire bed. This method is generally followed and gives the best results with a minimum of smoke if the combustion chambers are properly designed. The coking system is used when a grade of coking coal is fired. It consists in throwing coal onto the front of the grate and allowing it to coke there. When this process is completed an evener is used to spread the coke over the fire bed and new coal is then thrown on the front of the grate again. This method gives good results.

In firing boilers the fireman should see that every thing is kept clean of soot and ashes. This includes the ash pan, fire box and back combustion chamber, the tubes and boilers, the breaching and the stack. If this is not done, coal will be wasted and the boiler will prove inefficient.

The Milwaukee, Wis., Journal states that curtailment of production has been less in the cement industry this past year than in any industry, amounting to about 1 per cent under last year.

Portion of 8,000 Yard Capacity Storage.

Legal Aspects of the Fire Insurance Policy

Written Expressly for PIT AND QUARRY by Dwight Ingram*

"YOU don't need to look at this policy. It's a simple promise to pay."

Laying the document on his client's desk, one of Chicago's biggest insurance brokers used to make this speech in delivering his policies. An ideal that certainly would be. A business has many risks of destruction of its own plant and of liability for damage to property of other people. What a millenium it would be for the buyer of insurance if he could just order a big blanket policy to cover loss from any cause. In a few instances, notably in the case of personal jewelry, London Lloyd's will issue a policy where it is only necessary to affirm that yesterday one owned such and such an article in good condition and today it is damaged or missing.

But such broad policies have not yet been adapted to industrial needs. In fact, therefore, the fire insurance policies which a business man secures are not simple promises to pay. They are legal contracts under which the insurance company agrees to cover a specific loss if the insured fulfills his obligations under the bargain. The general rules of the contract are simple, however, and a buyer need never worry about collecting his losses if he will learn to look for the important sentences of his policies.

At the outset one finds that the very basis of adjusting losses is often misunderstood. As a policy holder how much will you collect if your property is destroyed by fire? You will have to pay out the price of a new building, and therefore you would like to recieve the full replacement cost. Yet your old building is worth less than a new one by the amount of its depreciation. This is not a real physical value. The proper handling of depreciation is to lay aside a reserve each year, so that this special fund plus insurance will equal the replacement cost. Depreciation does not mean absolescence or lowered commercial value because of neighborhood changes or unsuitability. It is pure wear and tear.

*Engineer—Moore, Case, Lyman and Hubbard.

For a loss on building or machinery, then, the policy holder will receive the cost of replacement at current market prices minus the depreciation. Such indemnity will be the monetary equivalent of the actual physical value for the foundations, which can be left uninsured. In the case of buildings erected before 1920 this amount may be more than the original cost, because the increase in building prices has generally been greater than the depreciation. As for the rate of depreciation, insurance men use the rough basis of about two per cent annually on frame buildings and from three-quarters to one per cent on brick. The rate is not uniform, of course, because the annual wear and tear is probably greater on an old building than on a new one.

The greatest confusion over fire insurance policies comes from the much misunderstood coinsurance clause. With all of the thousands of times it has been explained there are still people who think that an "80 per cent clause" in a policy means that the insurance company will pay only 80 cents on the dollar of any loss. As a matter of fact the coinsurance clause merely establishes a basis for the carrying of insurance. Under it the property owner agrees to carry insurance up to at least 80 per cent (or 70 per cent or some other definite figure) of the value of his plant. If he actually does carry total insurance equal to from 80 per cent to 100 per cent of the value, the clause is automatically void; he will receive one hundred cents on the dollar for any loss up to the face of the policies. Also small losses are paid without reference to coinsurance through a provision that no appraisal need be furnished if the loss is less than two per cent (in some states this is five per cent). The purpose of this exemption is to avoid expense and annoyance in settling small claims. Coinsurance operates only when a property owner fails to keep his insurance up to the agreed percentage. In such a case he will have to bear a part of any loss in proportion to the deficiency in amount of his policies.

The principle can probably be seen from the following contrasting situations, using the 80 per cent coinsurance clause for illustration:

Correct Insurance

Value of building			$10,000
Minimum insurance required under 80% clause			8,000
Insurance actually carried			8,000
Amount of loss			4,000
Insurance company pays	8,000	or	4,000
	8,000		
Policy holder pays (loses)	0	or	0
	8,000		

Careless Insurance

Value of building			$10,000
Minimum insurance required under 80% clause			8,000
Insurance actually carried			6,000
Amount of loss			4,000
Insurance company pays	6,000	or	3,000
	8,000		
Policy holder pays (loses)	2,000	or	1,000
	8,000		

In the second case the property owner stands in the position of an insurance company to the extent of the deficiency and actually collects only six-eighths of any loss he may sustain.

Most violations of the coinsurance requirement are made unwittingly by policy holders. They arise from neglect. Building owners fail to increase their insurance when building costs go up, or merchants and manufacturers forget to see the insurance agent when their inventory increases. The penalty for carelessness is severe, and the proper amount is a matter of importance because coinsurance is found on almost all policies covering commercial property, being compulsory in some cities and virtually so elsewhere because of a great penalty in rate which is assessed for omission of the clause.

Coinsurance fundamentally is not for the protection of insurance companies, because in the long run they will adjust their premiums to fit any loss record and will come out even. The coinsurance clause protects the efficient property owner against his careless or unscrupulous neighbor. Honest rates are obviously impossible without some uniform basis. We cannot measure the difference in fire hazard between a machine shop and a stock of millinery unless both are carrying the same proportion of insurance. This requirement comes from the fact that most fires do only partial damage and do not completely destroy the insured property, so that a small amount of insurance would cover many losses. A generation ago the owner of stock of pipe would demand a low rate because his goods were incombustible, and then would carry only enough insurance to cover the cost of drying the pipe after fire. As far as the company is concerned his small loss would use up all his insurance and would be as total as the complete wiping out of a hay barn. Lower rates and less insurance do not go together. With coinsurance it can be assumed that everyone is carrying insurance equal to eighty or ninety per cent of his property value, and rates truly reflect the relative risk of fire damage.

Many of us continue a popular error by saying loosely, "I have insured my building." In reality you have not insured your building. What you have insured is your interest in the money value of the building. This is not puerile bandying of words, because the difference between the two meanings constantly results in policies that do not cover what they are supposed to cover. Since it is the owner and not the property that is insured, one can understand that any new mortgage interest, transfer of title or liability for property held in trust for others affects the policies vitally and must be immediately reported to the insurance agent.

If a fire insurance policy is not a simple promise to make good any bad luck that strikes a plant, then it must cover some specific risk. That risk is stated in the contract to be "all direct loss or damage by fire" or lightning. The lightning clause means damage done directly by bolts and fire resulting therefrom; it does not include damage from wind or hail that may accompany or follow the lightning, since these risks are covered by windstorm insurance. Also the policy does not cover "friendly" fires. It is a universal principle of law that was recognized when a court recently dismissed a suit against an insurance company on these facts: a householder had hidden some jewelry in a stove for safety during the summer without his wife's knowledge and she later set a fire in the stove and damaged the jewelry. A "friendly" fire is one that is intentionally lighted for some useful purpose and that does not spread beyond the place it is supposed to be in. The policy does not cover loss due to war, riot, labor trouble or explosion. This is an important limitation, for the exclusion of labor trouble as a cause names even

indirect damage, which might be stretched to include fire spreading from other buildings where there was a suspicion of incendiarism by employees. These losses are taken out of the fire policy because they are themselves another kind of insurance, and it is obviously correct not to have different policies overlap.

The adjective "direct" in the phrase "direct loss or damage" excludes losses in which the damage by fire is indirect or consequential. The clearest case of a consequential loss would be the withering of plants in a greenhouse in winter due to the destruction of the boiler house. My father once had to adjust a case that was not so clear. A livery stable in a small Indiana town took fire, and two of the horses, becoming frightened, dashed out and ran half a mile to a river where they drowned. They were not burned to death, the fire merely scared them; yet their drowning was a consequence of the blaze. The most likely instance of indirect loss in the gravel and stone industry would be the flooding of a quarry due to fire damaging the pumps. There are no hard and fast rules distinguishing direct from indirect fire loss. Each case must be amicably settled on its own merits or carried into court and turned over to the uncertain decision of a jury.

The policy is a contract. A policy is enforceable only if the insured lives up to his end of the bargain. So it is vital for the property owner to learn what is expected of him. The chief duties of the insured are as follows:

(1) Give the agent exact and truthful information concerning the ownership and description of the property to be insured. This means first of all reporting any mortgage or other lien. And it is also a factor in case the plant consists of two or more buildings insured under a blanket policy with an "average rate". Not infrequently an insured tries to get a slightly better average rate by juggling his estimate of the division of value between his buildings, trying to place the biggest amount on the sections with low rates. All insurance is invalid if any material fact has been misstated, and both insurance companies and state commissioners have thrown into the waste basket policies that have any taint of fraud.

(2) Pay the premium in advance or as soon as required in the particular state. This payment is an essential condition of the contract.

(3) In case of fire use common sense in taking all possible precautions to protect the salvage from further damage. Remove it to other premises, cover it with tarpaulins, handle it as carefully as if you had no insurance.

(4) Notify the agent if you make any lease or contract with a railroad in which you agree not to sue the railroad in case you have a fire due to its act or neglect. It is a principle of common law that anyone who causes damage shall pay for it. Insurance companies use this principle to punish those responsible for fire, and their policies are void if they lose this right unknowingly.

(5) Notify the agent if your building, or any part of it, collapses. A weakened building is a poor fire risk, and the insurance must be immediately readjusted.

(6) Notify the agent if you do anything which increases the fire hazard. Your policy is based on a certain rate which measured the fire hazard of your plant on the day the policy was written. If you should, for instance, bring a drum of gasoline into your building you would create a risk which the company did not intend to carry. If on the other hand, you remove an old hazard, you are entitled to a rebate or reduction in rate. The policy holder is therefore both morally and legally required to notify the company of any change in the fire risk. Just what changes may be ignored and which shall be reported must be determined by the insured's own judgment. The policy contains a broad permit "for such use of the premises as is usual and incidental in the business," and this will take care of minor changes from day to day, and probably even the change from coal to a fuel oil heating system. Essential increases in hazard that must be reported are; any extension of a building, the transfer of a process from one building to another, the addition of a new industrial process in any building, the handling of gasoline or other highly inflammable material.

Almost every fire insurance policy issued has printed on its face a request that it be read. Very few people, however, open their policies. We are careless, we put too much faith in the accuracy of our insurance agent, or we are confused by the

great mass of fine print. A business man can develop an adequate short-cut, though, which will enable him to check his policies without loss of time. The "fine print" can be read once and then never again; for it contains the standard clauses that are never changed. What one must check on each policy is only the following:

(a) Everything that is typewritten,—the dates, amount and name of insured owner.

(b) Description and location of the property covered. This is usually the first paragraph of the form or rider that is attached to the policy.

(c) Look for the coinsurance clause.

(d) Read all small riders or rubber stamps.

In summary, the policy of any good insurance company is always worth its face value if it has been written right. But the correctness must be determined before the policy is accepted, for after the fire it is too late to change.

New Incorporations

The Gull Bar Sand & Gravel Co. of Toledo, Ohio, has been incorporated for $10,000, by Krank D. Lamb, Harry G. Lamb and C. M. Collins.

The Ambrose Sand & Gravel Co. of Bonham, Texas, has been incorporated for $10,000 by D. M. Penn, H. A. Cunningham and C. T. Aspelmier.

The Yeager Builders' Supply Co., Inc., Buffalo, has been incorporated for $105,000 to manufacture cement and building supplies. Incorporator, M. A. Yeager, 71 Shenandoah road, Buffalo.

The Patchogue Duntile Co. of Patchogue, New York, has been incorporated for $15,000, to manufacture brick, stone, etc., by S. J. Bronski and A. D. Shoenfeld, Jr.

The H. E. Fletcher Co., Westford, Mass., has been incorporated for $100,000 and 10,000 shares without par value, to produce stone, metals and minerals, by Herbert E. Fletcher, Harold H. Fletcher and Ralph A. Fletcher of Westford, and David Billson of Chelmsford.

Recent Patents

The following patents of interest to readers of this journal recently were issued from the United States Patent Office. Copies thereof may be obtained from R. E. Burnham, patent and trade-mark attorney, Continental Trust Building, Washington, D. C., at the rate of 20 cents each. State number of patent and name of inventor when ordering.

1,512,236, Crusher. Paul Phelps, Columbus, Ohio, assignor to Vogt Bros. Mfg. Co., Louisville, Ky.

1,512,406. Sand-cutter. John E. Chambers and Emmett L. Van Dolsen, Shelbyville, Ind.

1,512,936. Self loading and unloading scraper and method for operating the same. David B. Knapp, Philadelphia, Pa., assignor to Co-operative Utilities Co., same place.

1,513,283. Sand cutting and screening machine. Boyd Simpson, Bellefontaine, Ohio.

1,513,744. Unloading and excavating machine. Lincoln H. Clements, Clements, Mich.

1,513,855. Crusher. Paul Phelps, Louisville. Ky., assignor to Vogt Brothers Co., same place.

1,514,008. Combined material removing and conveying machine. James P. Mosier, St. Francois, Mo., assignor to National Lead Co., New York, N. Y.

1,514,009. Screening machine and vibrating hammer therefor. Herand K. Najarian, Bonne Terre, Mo.

1,514,048. Mining-machine. Morris P. Holmes, Claremont, N. H., assignor to Sullivan Machinery Co., same place.

1,514,097. Loading apparatus. Glenn W. Packer, Chicago, Ill., assignor to Goodman Mfg. Co., same place.

1,514,204. Mining-machine. Edward J. Doberstein , Blue Island, Ill., assignor to Goodman Mfg. Co., Chicago, Ill.

1,514,224. Crusher-lubricating system. Ray C. Newhouse, Wauwatosa, Wis., assignor to Allis-Chalmers Mfg. Co., Milwaukee, Wis.

1,514,269. Mining-machine. Halver R. Straight, Adel, Iowa.

1,514,673. Flume-screen. Gustav R. Roddy, Milwaukee, Wis., assignor to Chain Belt Co., same place.

1,514,817. Elevating-shovel. William C. Anthony, Streator, Ill., assignor to Anthony Co., same place.

Newburgh Crushed Stone Company Operating in Eastern Territory

Competing with Larger Producers Effectively in New York Quantity Production Not Essential but Quality Important

MUCH has been written of the advantages of the large plant. These advantages lie chiefly in the field of sales and purchases. It is well to consider some of the advantages of the smaller or moderate sized plants. When quantity production is not essential and quality is important, the small plant is not only able to compete with the larger plant, but it has some distinct advantages.

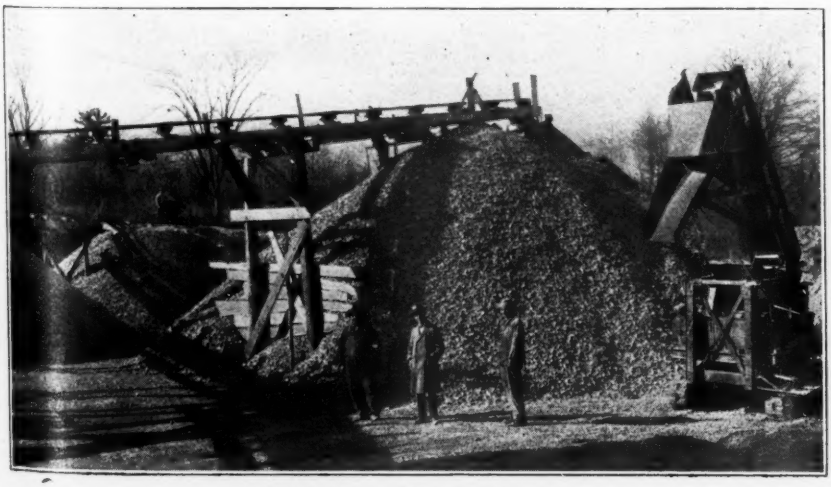
In the case of the Newburgh Crushed Stone Corporation the actual managers are the owners with a keen and vital interest in the plant operations. They can act quickly and adjust their policies to changed conditions as they come up. The influence of a magnetic personality such as that of Mr. Kehoe reaches the whole force without having to filter through a set of officials.

The operations of the Newburgh Crushed Stone Corporation are concerned with the one plant. Direct personal contact governs. The overhead is unusually low.

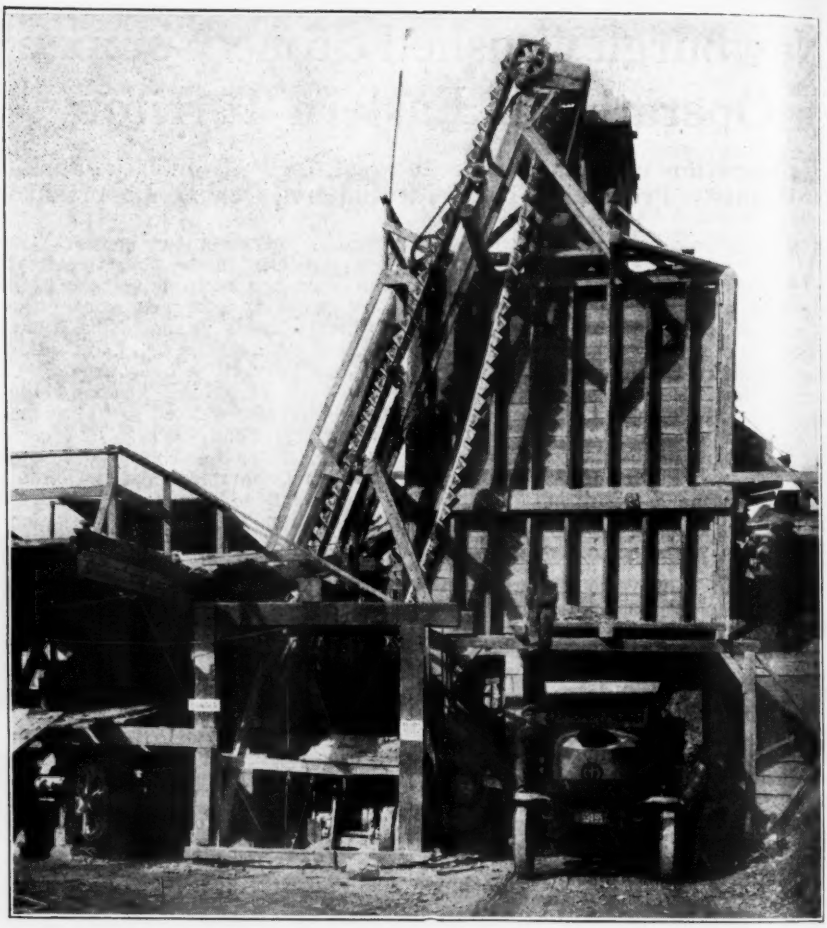
The plant of the Newburgh Crushed Stone Corporation is located on the Little Britain Road about one mile from the city limits and has been in operation for a short time. The corporation was formed early this year and secured a lease of the Carr property where a good supply of limestone is found. The quarry face has an average height of 50 feet and has very little overburden. The stone is a very high grade of limestone and has passed tests adopted by the American Society of Testing Materials for the New York State Highway Department and the Federal Government. The stone is well adapted for walks, driveways, concrete and macadam roads, and for agricultural purposes. Plans are now being made for the erection of the latest type kiln to care for local construction and farm trade.

The plant consists of one 12x24 primary crusher, one 10x18 secondary crusher, Sullivan air compressor, air receiver, hyspeed drills, blacksmith and machine shops.

Two yard side dump cars are used to convey the stone from the quarry to the crushers. The cars are loaded by hand, pushed to a main track and then hoisted up an incline 200 feet long with a single drum hoist of 3 tons capacity, and dumped on a tip-



Ground Storage Conveyor System.



View Showing Bucket Elevator to Bins.

A General View

ple directly into the primary crusher. This tipple was designed by the quarry superintendent, John Sylvester, and is so arranged and counterbalanced that one man dumps cars with ease. Four spur switches run from the quarry to the main track, and the distance is so short that two cars can keep the plant in continuous operation. The product of the primary crusher is conveyed on a bucket elevator with 50 feet centers to a 36 inch x 20 foot roller bearing revolving screen made up of three sections. Here four separations take place. The dust is removed by the aid of a dust jacket placed at the head of the screen. The first section, 6 feet long with ⅝ perforations, takes care of small stone known as screenings used on walks and driveways. The second section, 6 feet long with 1½ inch perforations, takes care of ¾ inch stone used for concrete construction. And the last section, 8 feet long with 2¾ inch perforations, takes all stone known as 1½ inch commercial stone used for macadam and concrete streets.

Oversize stone that will not pass through this screen is carried back by a gravity chute to the secondary crusher and recrushed. It is then elevated back to the screen by the same elevator that carries the output of the primary crusher. Should the market demand small size stone, a sectional blanket designed by the Corporation can be bolted around the last section of the screen and all stone larger than ¾ inch is returned to the secondary plant for recrushing.

The storage bins have a capacity of 300 cubic yards. The overflow is conveyed to stock piles by means of a 16 inch endless belt conveyor and a one yard car of the "all around dump" type which can dump from any point of the trestle.

Most of the current business for local trade is handled from the stone bins by trucks driven directly under them where they can be loaded from bottom discharge gates in a very few minutes. When it is necessary to load from stock piles, a Barber-Greene loading machine is used; so there is very little call for burdensome hard work. With storage for about 15,000 cubic yards it not only makes it easy to handle local trade, but also to take care of any large road or street paving contract in this vicinity. Another advantage in having large stock piles is for local city work where any quantity can be had on short notice.

The deep hole drilling is done with two 3¾ inch hy-speed drills, and block holing with jackhammers. Air is supplied from a Sullivan WG 6 12x10 straight line air compressor with the air receiver attached. Pipe lines run to different points in the quarry.

The equipment is all new and is electrically driven from current supplied by the Central Hudson Gas and Electric Company over a power line owned by the Corporation carrying 2200 volts. Each unit has its own motor. One 65 H.P. motor is used to drive the large plant; one 50 H.P. motor for the secondary plant; and one 65 H.P. motor to drive the air compressor. The motors and controls are housed in one building which is modern in every respect. The power

al View ry and Crushing Plant.

plant is protected in every way.

The crushing plant was designed by the Universal Road Machinery Company of Kingston, New York. The air plant and drilling outfit were designed by the Sullivan Machinery Company of New York, N. Y. Motors and controls were furnished by the Century Motor Company and the General Electric Company. The erection of the plant was under the direction of Mr. James L. Kehoe.

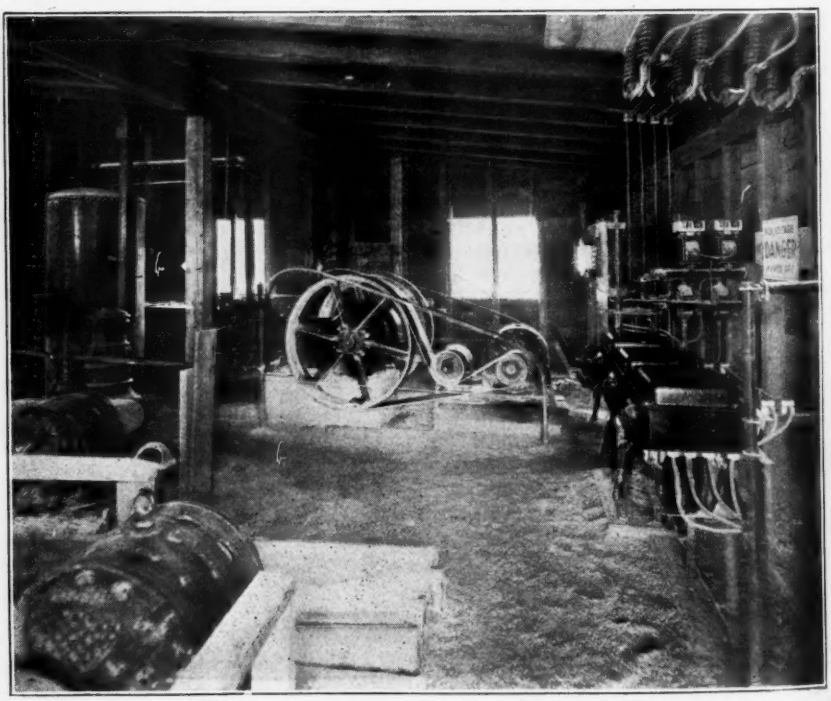
The officers of the Corporation are, John L. Sloan, President and Secretary, and James L. Kehoe, Treasurer. The quarry and crushing plant are in the charge of John Sylvester, Superintendent, with Theodore Dimmick in charge of the power plant.

Portland cement is holding its position in the market, and large quantities are being absorbed for current operations. There is no change in price levels. Contractors and dealers are securing stocks under a $1.95 mill base in the New York section, with a figure of $2.15 a barrel in carload shipments alongside dock; delivered to the jobber or to dealers' yards, $2.50 and $2.60.

Link-Belt Mixing Car

A new and somewhat novel mixing car has recently been designed and manufactured by the Link-Belt Company of Philadelphia, for use in glass factories where it travels back and forth under raw material storage bins, for the purpose of bringing together and mixing sand, lime, and other glass ingredients.

A steel drug 6 ft. by 4 ft., having 4-ton capacity, is mounted on the steel car truck. It is suspended from an overhead frame with a beam-type scale interposed between it and its own frame. Six separate beams are used on the scale, each operating independently and automatically, assuring accurate and proper measuring of the ingredients in the mixer. The car also permits the operator to travel along under the bins withdrawing the proper amount of each element. The operator can close the door and rotate the drum, thoroughly mixing the batch at the same time the car is running. There are two 10 H. P. motors used, one for propelling the car, one for rotating the drum. Both motors are equipped with adjustable speed controllers



Interior View of the Power Plant.

Special Sands

By W. M. WIEGEL*

SAND is one of the most useful and, fortunately, one of the most common mineral commodities. By far the largest proportion of the production is used in construction, including all forms of building, concrete and paving. Sand for this purpose is produced in every state in appreciable amounts. Excluding sand used for railroad ballast, molding sand stands next in tonnage produced, followed by glass sand.

In addition to the above, many grades of sands, with special characteristics, are used in industrial processes, and may be classed in a group as "special sands." This includes filter sand, sand ballast sand, engine sand, abrasive sand, fire or furnace sand, special flooring sand, roofing sand used as a finish for prepared roofings and pottery placing sand. Sand ballast and filter sand have been discussed in previous reports.

Very few sand companies depend upon the production of any one of these grades, as their source of revenue. They are generally especially prepared from the bank run of sand by different methods of screening or washing, or may, in some instances, be by-products from the production of other grades. Many companies not now producing them might be able to supply local demands by a slight addition to their plant. In nearly all cases, they command a better price than the usual grades of building sand.

Definitions and Properties

Engine sand, or traction sand, as it is sometimes called, is used to prevent the slipping of the driving wheels of locomotives, or other self-propelling vehicles, on wet or slippery rails. Its greatest use is, of course, for railroad locomotives, but street cars use considerable amounts and mine locomotives require its use. As the sand must be very dry when used, most consumers have their own drying equipment, so it is often shipped damp, with its natural water content or that resulting from washing by the producer. It must be fairly fine and free from rubbish, leaves, small sticks, or large grains of sand or pebbles that would tend to choke the feed pipes and valves leading from the sand box to the rail. On the other hand, it should contain a minimum amount of dust and very fine particles, which tend to retain or absorb moisture and form lumps. A sand containing clay is unsuitable. As the grains are immediately crushed to a fine powder under the drivers, a fine pulverized silica would give the necessary tractive effect, but such a material would not flow through the feed pipes. Either a rounded or angular grained sand is suitable, except that very rounded grains are more inclined to roll off the rail before being caught under the drivers and be wasted.

The Pennsylvania Railroad System does not have a definite specification for engine sand, but states that it should be high grade, over 95 per cent silica, comparatively free from foreign particles, non-caking and have sharp, clean grains of such size that approximately all will pass a 20 mesh and be retained on an 80 mesh sieve. Table I gives the physical and chemical analysis of four sands used and the source.

The Southern Railway System also does not buy its engine sand to specifications, but tests sand from new sources and compares it with sand used that has given satisfactory results. They use as a standard an available sand on their line, which is a quartz sand, practically free from loam and with the following approximate screen analysis:

All through No. 10 and held on No. 40 sieve	40%
Through No. 40 and held on No. 80 sieve	55%
Passing No. 80 sieve	5%

The Chicago, Ottawa & Peoria Railway (Electric) tried to use a sand from their own pit, but it had a natural bonding property, and also would absorb moisture in damp weather, probably due to the presence of vegetable matter. Its use was abandoned and washed and dried silica sand produced at Ottawa, Illinois, is now purchased. Although the grains are decidedly rounded, the sand gives satisfactory service.

The United Railways Company, of St. Louis, uses Mississippi River sand after drying and screening through

*Mineral Technologist, Department of the Interior, Bureau of Mines.

⅛" mesh wire cloth. The excavation from the river, followed by overflow from the barges, gives it a partial washing that removes most of the silt.

The Washington, D. C. street railways and some of the railroads in the vicinity use washed Potomac River sand that is coarser than the ordinary. The screen analysis of a sample is as follows:

Passing 6 mesh	100.0%
Retained on 8 mesh	1.5%
Retained on 20 mesh	21.1%
Retained on 65 mesh	89.6%
Retained on 100 mesh	95.8%
Retained on 200 mesh	99.5%

Abrasive Sand includes several grades of products, among which may be classed glass grinding sand, stone, sawing sand, banding sand, sand for abrasive papers and various grinding and polishing operations.

Crude, rolled plate glass requires rough grinding to remove inequalities of the surface before it is given the final grinding and polishing. Sand is used for this purpose. The specifications are not strict and the cheapest sand that answers the purpose is generally used; so, in nearly all cases, local supplies fill the requirements. From two to three tons of sand are required to grind one ton of plate glass. The sand should be free from large grains and any rubbish which might tend to choke the pipes in the circulating system. High silica content is not essential, except that impurities would usually be softer than the quartz grains and hence of no value. Very fine material and clay are objectionable only to the extent that they reduce the amount of proper quartz grains present. Where no other supply is available, the same sand is used for grinding as in the glass mix. One company in the central states, mining their own sand for glass, dry part of their sand for the mix and divert the balance before drying to the glass plant for grinding. All the sand passes 20 mesh, and only a small amount is retained on 28 mesh. Ninety-one per cent is retained on 150 mesh. The sand is a rounded grain product. Producers in the Ottawa, Illinois district, market some of their product for this purpose. This has been screened through 20 mesh. Only the fines removed in washing are taken out.

An impure sand, containing rounded grains of stone which are not quartz, or much mica, is unsuitable. Any large grains, especially of quartz, are objectionable in that they may make deep scratches in grinding that are difficult to remove in the polishing process.

Sand for stone and marble sawing should be composed of tough, fairly uniform grains. Flat particles are objectionable and fines are wasted, as the coarser grains support the cutting edge, leaving no work for the finer grains. Many unsorted sands are, however, used for stone sawing on account of their cheapness and ready availability. Some plants use a sand approximately equal to No. 1 sand blast sand, the screen analysis of a sample being as follows: retained on 20 mesh, 0.4%; retained on 35 mesh, 79.6%; retained on 65 mesh, 99.6%.

TABLE I.

Pennsylvania System, Test Department.
Examination of Various Sands for Locomotive Standing Purposes. Altoona, Pa., 2-1-24
Sieving Test and Chemical Analysis

	No. 1		No. 2		No. 5		No. 6	
	Vineyard, Pa.		Burnham, Pa.		Newberry, Pa.		Menantico, N. J.	
Sieving Tests								
Sieve Mesh No.	20	80	20	80	20	80	20	80
Per Cent Passing	99.18	9.53	99.70	9.10	97.40	3.00	99.60	2.20
Per Cent Retained	0.82	90.47	0.30	90.90	2.60	97.00	0.40	97.80
Colour	White		Yellow		Brown		Brown	
Grains	Sharp		Sharp		Med. Sharp		Med. Sharp	
Kind of Sand	Crushed Rock		Crushed Rock		River		Lake	
Chemical Analysis								
Silica			99.34		99.22		94.62	98.16
Sesquioxide of Iron			Trace		Trace		....	....
Alumina			....		....		....	....
Lime			....		....		....	....
Magnesia			....		....		....	....
Loss on Ignition			0.18		0.16		1.02	0.36
Loss on Washing			0.14		0.38		0.51	0.52
Water Soluble			0.01		0.05		0.04	0.03
Chlorine			Trace		Trace		None	None
Sulphate			None		None		Present	Present
Caking Test			O.K.		Fair		O.K.	Fair

One large marble company uses a clean, washed river sand, with 3.70% retained on 10 mesh; 12.60% on 20 mesh; 33.8% on 43 mesh, and 98.6% on 100 mesh. At the same time, they state that clean sea sand is superior to the above product, if it were available at a reasonable price, and that stone sawers on the coast usually use sea sand. As the sand is used over and over, grains finer than 100 mesh are eliminated by flotation, as they are considered of little use. Another company uses a sand passing a $\frac{1}{16}$" mesh screen, and states that the elimination of fines is desirable. Both round and angular grains are used. One marble sawer advances the opinion that for rounded grains a softer blade should be used than for sharp sand, as it has less tendency to "ride" the round sand.

Sample No.	366	370
Retained on 35 mesh	4.0%	3.1%
Retained on 48 mesh	34.7%	15.1%
Retained on 65 mesh	71.8%	60.6%
Retained on 100 mesh	94.0%	92.1%
Retained on 150 mesh	99.3%	99.0%

Sand was at one time largely used for the surfacing of "sandpaper," but very little natural sand is now so employed. The grains of most natural sands, while being more or less angular, or "sharp," do not have the sharp cutting edges of grains broken down from larger fragments, and these sharp edges are especially desirable in wood-working. Material of the proper sizes, screened out in the crushing of rock quartz, is still used to some extent. Sand and quartz grains have been largely replaced by garnet and the artificial abrasives in the manufacture of abrasive paper and cloth, due to their better cutting qualities and greater toughness or resistance to breaking down of the individual grains.

Abrasive sand for the rough grinding of stone and marble on the rubbing beds is generally employed. Sharp, angular grains are considered best, but, as the sand is used over and over, and the larger grains soon broken down, a rounded grain sand should answer equally as well, as in fracturing, the round grain yields small, sharp grains. Different stone and types of finish require different grades of sand. For all work, however, large grains and pebbles should be screened out and an excessive amount of fines reduces the efficiency. Other things being equal, a high silica sand is best and one with hard, tough grains which will not readily break down.

Banding sand is one of the minor grades of abrasive sands. It was formerly largely used in the grinding, and especially, the beveling of plate glass, but has been replaced to some extent by the more rapid cutting artificial abrasives. This grade of sand is also used in the manufacture of some prepared roofings, where a very fine sand is desirable. It is produced as a separate grade in the Ottawa, Illinois district. The screen analysis of samples obtained from two producers is as follows:

Fire or Furnace Sand is the silica or sand used to line furnace bottoms and walls, especially in those furnaces making acid open hearth steel. A high silica content is essential, and such sand is usually called "silica sand." A small amount of bonding material is required to hold the sand in place until it has been fired or "burned in". If the sand is so pure as to be lacking in any bonding property, some bond, such as a plastic fire clay, is usually added. Many sands used for this purpose have sufficient natural bond in the form of silicates and iron oxide, usually present as limonite. A sand graded from coarse to fine is used. A small amount of fine material is desirable, as it assists in bonding, fills voids between the larger grains and makes a more impervious hearth. Also, the finer grains sinter more rapidly when firing the new hearth. Prepared, screened sands are often used, in which there are no large grains. Apparently, however, large pieces are not objectionable in all cases, as some producers market a crushed sandstone which has passed a 2 mesh screen (about ⅝"). The screen analysis of several typical furnace sands is given in Table II.

Sample No. 364 is used first as a steel molding sand by a Pennsylvania steel foundry, and the spent molding is then used as furnace sand for the bottoms of the open hearth steel fur-

naces. This spent sand is No. 363 in the table. No. 364 is the original washed sand, and the increase in fines in No. 363 is due mostly to the clay bond that was added for molding purposes. This spent sand was said to give better service than new sand. About 200 heats are obtained with each bottom. From the table, it is evident that a considerable range in size is permissible, as long as the material is well graded from coarse to fine.

TABLE II.

Screen Analysis of Furnace Sands.

Number	300	341	342	343	363	364
Source	New Jersey	Ohio	Ohio	Ohio	Pennsylvania	Pennsylvania
% Retained on						
4 mesh			9.50			
10 mesh		0.70	14.20	2.00	1.10	
20 mesh		2.90	16.90	7.30	2.20	1.00
35 mesh	0.80	28.70	37.50	34.50	7.90	8.50
65 mesh	19.30	82.40	79.30	81.00	65.50	68.10
100 mesh	78.40	94.32	92.60	93.50	82.10	87.90
200 mesh	95.80	98.80	99.20	99.00	89.40	97.20
Passing 200	4.20	1.20	0.80	1.00	10.60	2.80

Chemical analysis is important as effecting the refractoriness of the sand. Alkalies should be at a minimum. This eliminates sands containing much feldspar and mica. Clay is the best bond and the least objectionable impurity. Small amounts of iron oxide are not objectionable and probably play an important part in the bond.

As low as 80% silica sands have been used in extreme cases, but a silica content in excess of 95% is usually specified. Sample No. 342, Table II, has the following analysis:

Silica	97.27%
Alumina	0.80%
Iron Oxides	0.52%
Other Oxides	0.75%

Special flooring sand is used in asphalt mastic flooring. This flooring material is made up of asphalt cement, a sand aggregate and a fine, absorbent mineral filler. The Federal Specification Board has the following specifications for this sand, when intended for government use: "The mineral aggregate shall be sand and small gravel. It shall be clean, hard grained and free from clay, silt, organic and other foreign matter, and shall be properly graded from coarse to fine, so as to produce a mixture of greatest density and stability. It shall fall within the following limits:

Passing a No. 3 screen	100.0%
Total passing a No. 8 screen, not over	60.0%
Total passing a No. 30 screen, not over	40.0%
Total passing a No. 100 screen, not over	7.5%

Chemical composition is not specified.

Roofing sand as here defined, is the sand used in coating prepared roofing and not the material applied to roofs built up in place. Only white sand is suitable for this. A rounded grain product is desirable but sharp grained sand is used.

One manufacturer uses a fine, white sand of the following size:

Retained on 40 mesh	1.5%
Retained on 60 mesh	72.5%
Retained on 80 mesh	89.0%
Passing 80 mesh	11.0%
	100.0%

Another large manufacturer uses sand from two sources, with the following approximate screen analysis:

	A		B	
	Min.%	Max.%	Min.%	Max.%
Through 20 mesh	98		98	
Through 20 mesh on 28 mesh	20	30	10	15
Through 28 mesh on 35 mesh	35	50	20	30
Through 35 mesh on 48 mesh	20	30	25	35
Through 48 mesh on 65 mesh	0	10	5	20
Through 65 mesh		5		
Through 65 mesh on 100 mesh			5	15
Through 100 mesh				10

Both of these are rather uniformly graded sands, B being the finer, and

either of them would answer the physical requirements for a good glass sand.

Placing sand is used in the ceramic industry by manufacturers of white ware, wall and floor tiles, heavy clay products and refractories, as a packing in the saggers and between the shapes to keep the ware apart. It is of two general types; first, that used for white ware and refractories, which must be low in iron and other easily fusible or fluxing minerals. Sand for dark, heavy clay ware need not have such high purity. In addition, there are two general grades, coarse and fine, the coarse running from about 10 to 40 mesh and the fine from 28 to 100 mesh. One sample of finer grade gave 2% on 28 mesh, 42% on 48 mesh and 67% on 65 mesh. A good grade of glass sand would be suitable for most work. Extreme uniformity of grain is not essential, but coarse particles and dust are objectionable.

Mining and Preparation

Any one kind of special sand is seldom the entire output of a producer. It is more often a by-product, or side line, from the production of standard sands marketed in larger amounts. For this reason, the method of mining or excavation of special sands does not differ from those generally employed.

All engine sands are screened to remove foreign material and oversize grain. In addition, most of them are washed, which is sufficient to remove the excess fines. Sand No. 6, Table I, is the screenings removed from sand blast sand. The original sand has been double washed, so nearly all dust and fines have been removed. Another New Jersey plant markets some of its screenings from sand blast sand as engine sand. This is also a washed product. At St. Louis, the pumping of the river sand into barges permits the overflow of clay, silt and a large part of the fines. The wet sand is then hauled in railroad cars to the drying plant and dumped in concrete bins. These feed to a conveyor, delivering to a 4 feet by 20 feet rotary, direct heat drier. Moisture content of the wet sand was 3¼%. The capacity of the drier was 12 tons per hour, with a coal consumption of 1 ton per 73 tons of sand. The dried sand was screened over a ⅜" wire mesh on a rotary screen.

Abrasive sands, with the exception of sand blast sand and the small amounts used for coating paper and cloth, are not closely sized. Large grains and foreign matter are always objectionable, however, so it is almost universal practice to pass the sand over one screen to remove these. Banding sand in the Ottawa, Illinois district is the finer portion of the sand obtained through vibrating screens in the preparation of sand blast and filter sand. Sand, or crushed quartz, for abrasive papers, must be very closely sized into the different grades. This operation is not carried out by the sand producer, as the manufacturer prefers to keep this operation under his control and supervision.

Stone sawing sand is generally the quarry run, with large lumps screened out. However, some consumers prefer a sized product, about the same as No. 1 sand blast, as their tests have shown it to be more efficient, even at a slightly higher price. This is separated on screens, generally of the vibrating type, after the quarry run sand has been washed and dried.

At the different plants visited, there was noted a decided tendency toward the adoption of the electrically operated, rapidly vibrating screens, to displace the older rotary and stationary sloping type. One advantage is that they lend themselves to incorporation in dust collecting systems, which materially improves the working and health conditions, where dry screening is done.

General

The use of the various special sands is not restricted to any one locality or industry. For this reason, it is believed that many sand producers now only putting out one grade of ordinary sand could, by the installation of suitable equipment, be able to supply local demands in one or more grades.

Specially prepared sands command a better price than the ordinary quarry run of building sands, and a market of this kind would tend to level off the seasonal peaks of building demands.

Some sand deposits vary in character in different parts of the bed, so that certain portions may be unsuitable for general use, but might serve as a source of some of the grades here mentioned. Often these portions can be mined and handled separately. This practice was observed at several plants visited. At one New Jersey lake deposit, the sand is coarser on

one side and contains much gravel which is also handled as a major part of the product. The other side of the lake contains mostly fine sand, so two dredges are employed, each pumping to a separate washing and screening plant, one for the coarser sands and one for the finer.

Considerable difference of opinion exists as to the relative merits of round grained and angular grained sand, especially for abrasive purposes. The fact remains that both kinds are used for all purposes and doing the work required of them. So it is believed that, if prepared with equal care to the same specifications, there is little difference in their performance, if the grains are equally tough. It must be said, however, that, while the individual grains of most of the rounded sands are tough and free from flaws and microscopic cracks, a few of the angular grained sands have grains which break down more readily under impact, or shear, and hence are consumed, or "wear out" more rapidly, requiring more frequent replacement.—Reports of Investigations, Department of the Interior, Bureau of Mines.

Sand Diggers Very Active

Steamer and Barge Repair Yards Working at Capacity. Plants Working Hard to Accumulate Reserve.

By Our Pittsburgh, Pa., Correspondent

SAND AND GRAVEL producers in the Pittsburgh district are maintaining operations under heavy tonnage, with favorable market conditions lending impetus to the general situation. Sand diggers are being pressed into maximum service at the different pools, while river front activities are being carried out correspondingly. With the advance of the winter season, an effort is being made to accumulate sufficient reserve stocks to tide over low production weeks ahead and this, coupled with sizable current business, is making for busy times in the trade.

Leading producers are giving attention to their river fleets, both in the line of steamers and barges, and considerable repair work with equipment replacements continues in progress as in the weeks past. The repair yards, consequently, are making for good account these days, and practically every such plant is running under heavy capacity. New boat construction, likewise, is an important feature of the present situation, and a number of new vessels for the sand and gravel trade will be launched at an early date.

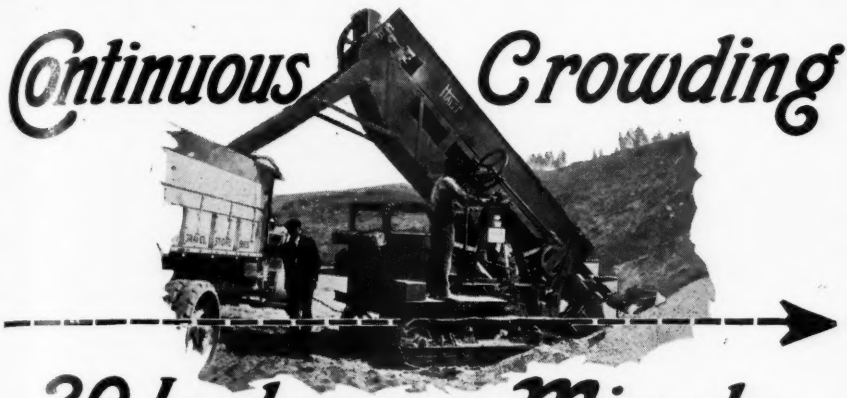
In the latter connection it is interesting to note the growing prominence of the Pittsburgh shipyards for sand and gravel fleet construction. In addition to local interest producers at Wheeling, W. Va., Chattanooga, Tenn., and Louisville, Ky., have recently placed orders for dredges and scows in this quarter, and estimates are out for considerable other work of this same character for operators in these and neighboring distant points. All in all, the forthcoming winter season bids to be a most active one with local boat builders.

Federal Engineers at Pittsburgh have made public tonnage figures for the local rivers in the past month, with the Allegheny River showing a total distribution of 113,930 tons of gravel, and 172,425 tons of sand; the Monongahela River has a record in this period of 108,650 tons of gravel, and 119,726 tons of sand; and the Ohio River, 96,497 tons of gravel and 113,307 tons of sand. Preliminary calculations for the present month indicate still heavier figures for the first noted river.

There is no marked change in quotations in the sand, gravel and affiliated markets at Pittsburgh, and only fractional variations have ensued during the past month. Barge deliveries on sand are around $1.00 per ton at the diggers, with an increase of 10 cents a ton per pool; f. o. b. company hoists, carload lots, a rate of $1.25 and $1.30 is current, with a slight discount in these figures to building material and other dealers; for material delivered on truck at company plants, a rate of $1.40-$1.50 applies. For good washed gravel, a current figure of from 65 cents to 75 cents at the diggers is being quoted, with the same increase of 10 cents per ton, per pool, as in the case of sand; at company hoists the rate on gravel is 85 and 90 cents a ton, while loaded material is priced at $1.10, at company plants.

Among the active producers in the local sand and gravel markets is the Iron City Sand & Gravel Co. which is keeping its diggers in the Allegheny River under full blast. J. K. Davison Brothers are holding to a good production schedule with heavy river fleet operations; sizable distribution is being maintained.

Continuous Crowding



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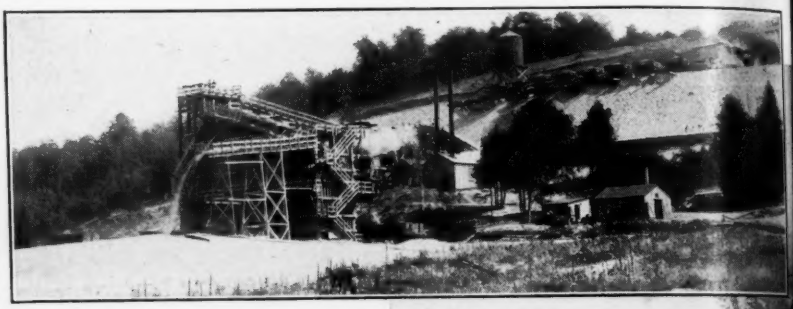


A. W. ROBERTSON, Ltd.
Tweed, Ont., Sept. 20, 1924.

The Fate-Root-Heath Co.,
Plymouth, Ohio.

Gentlemen:

We are using a PLYMOUTH 7-ton Gasoline Locomotive for hauling ten 6-yd. standard gauge dump cars from our pit to dumping trestle.

We also handle at our loading bins two and three open-top steel railway cars each loaded with 50 to 60 tons; also six empty railway cars up a one per cent grade, one mile in length.

Gasoline consumption per 10-hour day, working continuously, does not exceed 10 gallons.

We have had several years' experience with steam locomotives up to four side wheels and for our work would not think of making any other installation than PLYMOUTH Gasoline Locomotives.

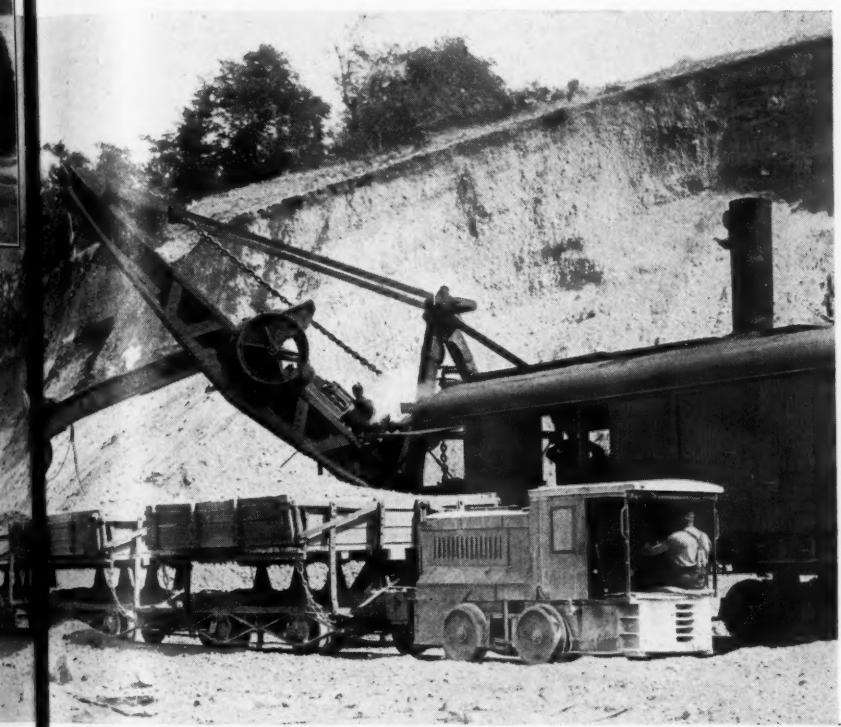
A. W. ROBERTSON, Ltd.,
(Signed) W. E. TUMMON,
Manager.

SEE OUR EXHIBIT AT NATIONAL GOOD ROADS SHOW, CHICAGO, JAN. 5-9.

Another Big M rn

A. W. Robertson, Ltd. Tweed, Ontario, has recent completed a big modern sand a gravel plant, with a capacity 2000 tons a day. A unique fe ture of the 400 acre deposit that at least half of it is in th form of a hill 225 feet high. Th pit is a side-hill cut about 75 fe up the slope.

Gasoline PLYM



ern Plant Chooses Plymouth

The equipment is the last word in efficiency and naturally the Plymouth Gasoline Locomotive was chosen to assume the haulage burden.

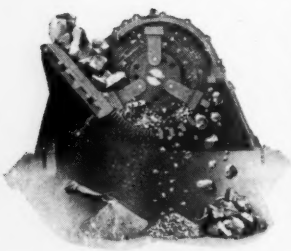
Read now the letter in adjoining panel from Mr. Tummon, then write for Bulletins "C" and "F" showing what others are doing in your field.

THE FATE-ROOT-HEATH COMPANY
Plymouth Locomotive Works
PLYMOUTH, OHIO

MOUTH Locomotives

"Makes Best Prepared Stone State Highway Commission Has Used"

Indiana State Farm, Greencastle, Ind.



Cross sectional view of Williams Hinged Hammer Crusher showing how any size rock can be made by using grates with larger or smaller openings.

The experience of the Indiana State Farm should interest all who crush rock. Their No. 3 Jumbo Junior crusher has not only taken the place of a No. 3 and No. 5 gyratory, but in addition the product is the best prepared and most uniform macadam the Indiana State Highway Commission has used.

This No. 3 Jumbo Junior crusher will take rock as large as 14" cubes and reduce to 1½", ¾" or even agstone if desired. Williams Mammoth type reduces 48" limestone to 1½" in one reduction. If you contemplate installation of crushing equipment let us show you how many plants have reduced operating expenses and cut investment 50%.

WILLIAMS PATENT CRUSHER & PULV. CO.
802 St. Louis Ave., St. Louis, Mo.

Chicago	New York	San Francisco
37 W. Van Buren St.	15 Park Row	415 5th Street

Williams

PATENT CRUSHERS GRINDERS·SHREDDERS

The Most Recent California Sand and Gravel Plant

The California Rock Company Producing at Eliot, Cal. Efficient Layout Insures Continuous Capacity Production

THE latest washed sand and gravel plant to come into operation in Central California is that owned and operated by the California Rock Company of San Francisco. The plant is located at Eliot, previously made famous for its gravel beds, midway between Pleasanton and Livermore. The company own approximately one hundred acres of land situated on an ancient river bed, yielding a very clean and washable quality of pit run material, and from borings it was determined that a salable quality of gravel extended to a depth of approximately 200 feet.

In the wet season the underground water supply is within twenty-five feet of the surface, so it was decided to put in a "sky-line" or slackline excavator, and the Sauerman equipment was finally selected. The mast is 112 feet high and stands on skids and planking so that it may be moved from time to time as circumstances demand. The operating span is 900 feet.

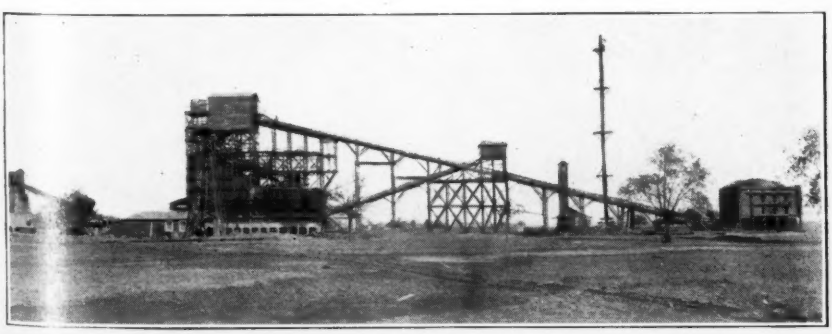
The bucket is a standard 1½ yard Sauerman type. The power unit that operates this bucket is a Sauerman two-speed motor hoist equipped with a specially designed two-speed 150 H.P. Lincoln electric motor, direct connected by means of gears to the hoist drums. The operator stands on a tower forty-five feet above the ground and, in this position, has a clear view of the digging operation and the field hopper where the bucket discharges its load.

The field hopper when full will contain an eight hours' run so that the excavator can be shut down some considerable time without delaying the mill. Under the field hopper are located two of the latest type Bodinson reciprocating feeders driven by variable throy accentrics, and equipped with fly wheels and counter-weighted gates. These feed gates are driven from the tail pulley of the 30 inch conveyor through friction clutches.

The field run of material is carried up to the top of the mill on a 30 inch belt conveyor inclined at 14 degrees, and at the top passes over a grizzly set with 4 inch openings between the bars. The material rejected by the grizzly is conveyed in a chute to the crusher bin, the balance passing through a revolving scrubber with a 2½ inch perforated conical screen on its outer end. The rejects of this screen go to the crusher bin.

The balance of the screens are of the Gilbert conical type, number 4 size, with 1¾, 1, ½ and ¼ inch perforations, respectively, and were furnished, together with all the elevating, transmission and conveying machinery, by the Bodinson Manufacturing Company of San Francisco.

The various pockets in the bunkers will hold a maximum of fifteen cars



A General View of the California Plant.

for delivery. The crushing department is equipped with two Telsmith crushers, primary number 10A and a secondary number 2. The primary crushes the oversize rock to minus 1¾ inches and this product is passed over a conical scalping screen with 1¼ inch perforations and the rejects from this screen are elevated and crushed in the reduction crusher.

The reduction crusher also has a chute from the number 1 bin, size from 1¾ to 2½ inches so that instead of storing this material, for which there is not a steady demand, it will be crushed into a more salable size. An 18 inch belt conveyor runs under both crushers and elevates the crushed rock back to the main conveyor and is passed through screens for sizing. The crushed material is mixed with the sized gravel. The sand is from ¼ inch down to fines and is washed and dewatered by means of a duplex rake type continuous classifier. The resulting product gives a perfect screen analysis, being so proportioned as to give a straight line chart. Bin runs of materials are loaded from one side of the plant and shipments for truck delivery loaded from the other side.

In a reinforced concrete tunnel under the bins is located the loading end of a 24 inch belt conveyor. It is by means of this conveyor and quadrant bin bottom gates that the various mixes are made. The sand being so well dewatered causes it to feed very uniformly through the gates onto the loading belt. This method of reclaiming from storage is becoming popular. The particular adaption at this plant however is interesting. The various sizes are dropped onto the belt and then carried to a hopper where the mix actually is made in the dumping. Then it is mixed further when it leaves the hopper and passes into the cars or trucks. The mixing is really all accomplished by gravity.

At the discharge end of the 24 inch conveyor belt is located a bunker in which is carried a carload of standard concrete mix. Trucks, therefore, can drive under this pocket and obtain properly mixed concrete mix at all times. In loading cars with mix materials the conveyor delivers to a chute beside the pocket and direct into the cars.

The plant operates a Brown locomotive crane for storing materials and switching cars. In this connection it might be mentioned that this piece of apparatus saved half of its first cost in the saving accruing from handling and hoisting timber machinery, etc., during the construction period of the plant. The boom of this crane is fifty feet long and it was necessary to extend it twenty feet to be able to hoist all of the lumber to the top of the frame over the bunkers.

The washing water is obtained from a deep well and is supplied by a six stage Western Well Works deep well turbine pump of 900 gallons per minute capacity. After several un-

The Main Conveying System.

usually dry seasons, this well seems very capable of supplying this water continuously.

The plant started operations on September 26th, and has been in complete production since that time. No defects have developed as yet and none are anticipated. The California Rock Company is incorporated under the laws of the State of California for $200,000, with a paid up capital of $150,000. With a very few exceptions all of the employees are stock holders in the corporation. The report of a San Francisco testing laboratory gives the materials produced by this plant a very high rating, stating they are way above the average.

The officers of the California Rock Company are Mr. H. R. Connor, President; Mr. P. C. Hansen, Vice President; Mr. G. M. Clark, Treasurer and Secretary. Mr. L. A. Frontz is superintendent of the plant. The plant is electrically operated with a capacity of 1,000 tons per eight hour day.

Bulletin No. 330, issued by The Bristol Company of Waterbury, Conn., manufacturers of Bristol's Recording Instruments, describes the Model 420 Bristol Pyrometer, which supercedes Model 319. This is the high-resistance model for wall or switchboard use, "a pyrometer easy to read even at a distance because of the wide open scale."

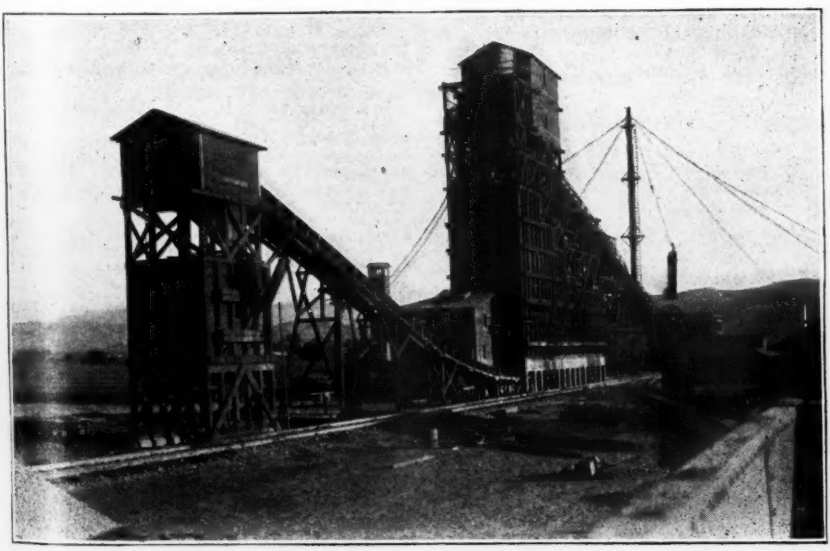
Sixth Annual Meeting, Missouri Valley Sand and Gravel Producers

The Sixth Annual Meeting of the Missouri Valley Association of Sand and Gravel Producers is planned to be held on Tuesday and Wednesday, December 16 and 17, at the Muehlebach Hotel, Kansas City, Mo. An unusually good meeting is anticipated this year with a very good program in prospect. As heretofore, the entertainment features will be provided by Kansas City producers.

Especial invitation is extended to the ladies of the Sand and Gravel fraternity. Reservations will gladly be made for all who communicate with Secretary W. E. Johnson, stating the number in the party, hotel preference, and kind of accommodations desired.

Brownhoist Booklet 8-24

Booklet 8-24, a bulletin on Clamshell Buckets, has been issued by The Brown Hoisting Machinery Co., Cleveland, Ohio. The Brownhoist Clamshell is described as a sturdy bucket of comparatively light weight, built as a general purpose bucket and for handling such materials as sand, crushed stone, coal and similar materials.



The Conveyor from the Bins to Hopper.

Portland Cement Statistics for October, 1924

The following tables, prepared under the direction of Ernest F. Burchard of the Geological Survey, are based mainly on the reports of producers of Portland cement but in part on estimates. The estimates for October, 1924, were made necessary by the lack of returns from three plants. Production and shipments were nearly at the same rate as in September; shipments reached a new high level. Stocks decreased considerably but are 33 per cent higher than in October, 1923.

Stocks of clinker, or unground cement, at the mills at the end of October, 1924, amounted to about 3,650,000 barrels compared with 4,260,000 barrels (revised) at the beginning of the month.

The Bureau of Foreign and Domestic Commerce of the Department of Commerce, reports that the imports of hydraulic cement in September, 1924, amounted to 134,245 barrels, valued at $226,227. The total imports in 1923 amounted to 1,678,636 barrels, valued at $2,964,098.

The imports in September were from Norway, 47,022 barrels; Belgium, 40,832 barrels; Denmark, 29,954 barrels; Canada, 14,310 barrels; Germany, 1,155 barrels; France, 447 barrels; Japan, 119 barrels; Spain, 6 barrels.

Production and shipments of finished Portland cement, by districts, in October, 1923 and 1924

	Production, October		Shipments, October	
Commercial District	1923	1924	1923	1924
Eastern Pa., N. J., and Md.	3,342,000	3,598,000	3,922,000	4,219,000
New York	731,000	809,000	864,000	983,000
Ohio, Western Pa., and W. Va.	1,266,000	1,495,000	1,412,000	1,919,000
Michigan	925,000	1,080,000	980,000	1,132,000
Wis., Ill., Ind. and Ky.	1,933,000	2,229,000	2,056,000	2,660,000
Va., Tenn., Ala., and Ga.	838,000	1,115,000	844,000	1,185,000
Eastern Mo., Ia. and Minn.	1,452,000	1,518,000	1,448,000	1,763,000
Western Mo., Neb., Kan. and Okla.	979,000	985,000	935,000	1,220,000
Texas	332,000	415,000	326,000	407,000
Colo. and Utah	217,000	275,000	206,000	278,000
California	1,049,000	1,062,000	1,021,000	1,036,000
Ore., Wash. and Mont.	286,000	239,000	271,000	279,000
	13,350,000	14,820,000	14,285,000	17,081,000

Production, shipments, and stocks of finished Portland cement, by months, in 1923 and 1924, in barrels

	Production		Shipments		Stocks at end of month	
Month	1923	1924	1923	1924	1923	1924
January	7,990,000	8,788,000	5,628,000	5,210,000	11,477,000	14,155,000
February	8,210,000	8,588,000	6,090,000	5,933,000	13,596,000	16,815,000
March	9,880,000	10,370,000	10,326,000	8,995,000	13,045,000	18,189,000
First quarter	26,080,000	27,746,000	22,044,000	20,138,000	.....	.....
April	11,359,000	11,726,000	12,954,000	12,771,000	11,463,000	17,159,000
May	12,910,000	13,777,000	14,257,000	14,551,000	10,144,000	16,403,000
June	12,382,000	13,538,000	13,307,000	15,036,000	9,168,000	14,903,000
Second quarter	36,651,000	39,041,000	40,518,000	42,358,000	.....	.....
July	12,620,000	14,029,000	13,712,000	16,614,000	8,081,000	12,319,000
August	12,967,000	15,128,000	14,971,000	16,855,000	6,080,000	10,666,000
September	13,109,000	14,519,000	13,698,000	16,827,000	5,533,000	8,404,000
Third quarter	38,696,000	43,676,000	42,381,000	50,296,000	.....	.....
October	13,350,000	14,820,000	14,285,000	17,081,000	4,612,000	6,143,000
November	12,603,000	.....	10,251,000	.....	6,991,000	.....
December	9,997,000	.....	6,408,000	.....	10,900,370	.....
Fourth quarter	35,950,000	.....	30,944,000	.....	.....	.....
Preliminary total	137,377,000	.....	135,887,000	.....	.....	.....
Amount of under estimate	83,238	.....	25,118	.....	.....	.....
Final total	137,460,238	.....	135,912,118	.....	.....	.....

Concrete and Concrete Aggregates

Written Expressly for PIT AND QUARRY by R. N. Van Winkle

THE erroneous impression is being created that the per cent of wear, or the French Coefficient of Wear, which is a number obtained by dividing the per cent of wear into 40, of crushed stone aggregates is a measure of the strength of the concrete made therefrom and that crushed stone having a French Coefficient of Wear of six (6) or more, or a per cent of wear of not more than six (6) or seven (7) is the only crushed stone suitable and acceptable for concrete construction.

To correct the above impression the results of tests which have been made by reliable engineers who by experience are qualified to pass on this subject, are given. In Engineering News-Record, June 29th, 1922, F. E. Giesecke, Head, Engineering Research Division, University of Texas, gives the results of compression tests of concrete made with Trap Rock and soft limestone, two extremes in aggregates, which compare as follows:

Characteristics of Congrete Aggregates

	Crushing Strength No. sq. in.	Specific Gravity	Per cent Wear	Hardness	Toughness
Trap Rock	33,600	3.13	1.00	18.34	32.00
Soft Limestone	4,400	2.03	8.72	00.00	2.00

The results of twenty (20) tests of these two widely different aggregates with five different proportions of cement for each aggregate gave average compression strengths of concrete as follows:

Compressive Strength of Concrete Per Square Inch in Pounds

Trap Rock	5,871	6,828	7,704	8,004	8,536
Soft Limestone	6,408	7,733	8,467	9,049	9,072

Mr. Giesecke states, "It is evident from these figures that, for materials tested and for the proportions of cement ordinarily employed in practice, the strength of concrete varies only slightly with the strength of the coarse aggregate. For very rich mixes and high ages the strength of concrete increases slightly with the strength of its coarse aggregate, but for ordinary mixes and an age of 28 days, the strength of concrete made with comparatively weak limestone aggregate is as high or higher than that of a similar concrete made with the strong igneous rock aggregate.

"The explanation of this remarkable result may be that as the strength of the stone increases, its surfaces become smoother and consequently the bond between the matrix and the aggregate becomes weaker; and that the loss in strength of concrete due to weaker bond is about equal to the increase in strength due to the higher strength of the coarse aggregate.

"It is generally believed that the strength of concrete depends partly on the strength of matrix, partly on the bond between the matrix and the aggregate and partly on the strength of the aggregate. In order to ascertain the extent to which the strength of concrete is determined by the strength of its coarse aggregate a series of tests has been undertaken by the Engineering Division of the University of Texas. The results of the 28 day and 3 months tests of this series indicate that, for the material tested, the strength of concrete is almost independent of the strength of its coarse aggregate."

Again let us take the results of tests made by the Bureau of Public Roads, Washington, D. C. These tests were made in 1923 and show results of compression and cross bending tests made of concrete used in several sections of the Bureaus test and experimental road at Rosyln, Virginia.

Comparison Between the Strength of Gravel and Stone Concrete

	Per cent of Wear	Compressive Strength	Modulus of Rupture
Quartzite	1.8	4139	677
Limestone	14.5	4878	599
Gravel	9.3	4345	659
Gravel	29.0	3827	544

The proportions in which the above concrete was made 1-1½-3 by volume, Age 90 days (kept wet 14 days, balance in air), Graded ¼-1½", Slump approximately 2".

Doubtless the gravel referred to in the above was tested by the modified method and a number of tests which the Bureau of Public Roads has made would indicate that, in general, gravel of equal quality to crushed stone will show a percentage of wear about 3 times as great. The above tests show conclusively that aggregate strength is no measure of concrete strength,

and further show comparisons between the strength of gravel and stone in concrete.

In further regard to the French Coefficient of Wear being a measure by which to select or accept crushed limestone, particularly for road building purposes, we beg to quote from a letter written by Mr. H. F. Clemmer, Engineer, Tests Division of Highway, Springfield, Illinois, under date of June 12, 1922.

"Tests on stone having a coefficient as low as five (5) show results similar to those obtained on stone having a higher coefficient and it is our honest intention to change specifications accordingly."

To continue along this same line of thought, we beg to reprint part of a letter written by F. H. Jackson of the Bureau of Public Roads and published in Engineering News-Record, August 17, 1922.

"Experience in Illinois and other states where comparatively soft aggregates abound would indicate that the per cent of wear may be raised considerably above the limit which has previously been considered safe, without seriously affecting the quality of the resulting concrete. The writer believes that the orthodox interpretation of the results of 'French Coefficient' tests may be questioned in the light of these several indications."

Mr. Duff A. Abrams of the Structurals Materials Research Labratory of Lewis Institute in Chicago certainly left no question of doubt when he read before the American Road Builders Association in January, 1922:

"There has been a marked tendency to lower the limiting per cent of wear for crushed rocks to be used in concrete roads; this is particularly due to recent changes in the type of traffic and to a growing realization that the wearing resistance of the aggregate has only a remote bearing on the wearing resistance of the concrete."

The wearing resistance of concrete is truly a factor in concrete highway construction, but you will note from the above that Mr. Abrams says the wearing resistance (per cent of wear, or French Coefficient to Wear) has only a remote bearing on the wear resistance of the concrete, and Mr. Abrams further states in his Bulletin No. 10 "Wear Test on Concrete":

"The quality of a fine or coarse aggregate produced less effect on the wear than is commonly supposed. The wearing resistance of concrete is determined largely by the quality of concrete rather than by type of aggregate. Good concrete can be produced from aggregates which are generally considered inferior, if other factors are properly taken care of."

From the foregoing it would be fair to assume that per cent of wear and the French Coefficient of Wear of aggregates has little or no bearing on the strength of concrete and that the French Coefficient of Wear and the per cent of wear of aggregate have only a slight bearing on the wear of concrete made therefrom, but that concrete of high strength does show greater resistance to wear than weak concrete. On this point Mr. Abrams says in his Bulletin No. 10, "Wear Tests on Concrete":

"In general the factors which give concrete of high strength also gave concrete of low wear (a high resistance to wear)."

The average contractor, engineer and inspector have been in the past, it seems, too ready to lay any deficiency whatsoever in concrete immediately at the door of the material producer, claiming a poor fine or coarse aggregate or faulty cement, the result being rejection of materials, while in fact we are beginning to learn by experiments and tests that there are other factors in the making of concrete which have more bearing on the ultimate strength and wearing qualities of concrete than the coarse and fine aggregates.

It has been demonstrated without question that aggregates which are clean and structurally sound will make the best concrete regardless of the French Coefficient of Wear, if proper consideration is given to the quantity of mixing water in the concrete, the grading of aggregates, the quality of cement, the time consumed in mixing a batch of concrete and the curing of concrete. Uniformity of the aggregate and not the French Coefficient of Wear is prerequisite to concrete strength.

Concrete has been much abused. The gunny sack contractor with little experience and less equipment has no conception of the relative importance of the factors entering into and controlling mixtures and proportions of concrete and its aggregates, and this can easily be evidenced by the class of finished work he produces. The slip shod methods used in many in-

stances in mixing are only conducive of failure of resulting concrete. Many women, given the best ingredients the market affords and the best equipment, will fail to make and bake a good cake. You all know this is true, and why—just because she does not know how, and this same homely rule applies to making concrete; but like the woman the contractor does not want to admit defeat and blames the ingredients as also does the woman making the cake.

The time has come, and should be welcomed by all progressive contractors, engineers and material producers, when the proportioning of aggregates and the mixing of concrete will be put on a more scientific basis and to identify these scientific methods from the old slip shod practices, we might term the results of scientific methods, "Scientific Concrete".

In the making of scientific concrete, as we will term it, several factors which are doubtless new to some will present themselves, such as the slump, plasticity or workability, water ratio, gradation of aggregate, consistency, fineness modulus and time of mixing.

Slump is the settlement of a truncated cone of concrete from its original height of 12", measured in inches, and is the simplest and most practical way of determining the proper amount of water to use in mixing concrete.

Specifications should indicate the workability of concrete desired for different types of construction. For the usual reinforced work a slump of 6 or 7 inches should be aimed at; in mass work a slump of 1 to 4 inches may be used; for concrete roads in which finishing machines are used a slump as low as 1 inch may be used.

The strength of a concrete mixture depends on the quantity of mixing water in the batch, expressed as a ratio to the volume of cement so long as the concrete is workable and the aggregates clean and structurally sound. The strength of concrete decreases as the water ratio increases.

There is an intimate relation between the size and grading of the aggregate and the quantity of water required to produce concrete of a given workability. The strength of concrete is affected by the size and grading of aggregate only in so far as the quantity of mixing water is influenced by these variables, so long as the aggregate is not graded too coarse for proper workability. Fine aggregates require more water for a given plasticity and quantity of cement, and therefore give a lower strength than coarse aggregates.

The quantity of mixing water is generally expressed in terms of the "Relative Consistency" of concrete. A relative consistency of 1.00 requires such water that a freshly molded 6x12 inch cylinder will slump ½ to 1 inch upon removal of the forms by a steady upward pull. A relative consistency of 1.10 indicates the use of 10 per cent more water than required for a relative consistency of 1.00. The quantity of water is also expressed by the "Water Ratio" as the ratio of volume of water to volume of cement in a batch.

The term Fineness Modulus refers to the grading of aggregate, but it will suffice to give here only the definition of this term and suggest to the layman to consult a testing engineer or laboratory regarding the application of this term to the particular work.

Fineness Modulus is used as a measure of the size and grading of the aggregate. This value is the sum of the percentage in the sieve analysis divided by 100, when the sieve analysis are expressed as percentages coarser than each sieve. A high value of fineness modulus represents a predominance of a coarse aggregate and a low value a predominance of a fine aggregate.

Mixing concrete—It is desirable that concrete be mixed at least one (1) minute in a batch mixer of approved type after all materials are in the drum.

It would appear and is certainly within reason that with proper cooperation among the engineers, the contractors and the material producers that "Scientific Concrete" can be produced to meet any load requirement or strength within reason and moreover that concrete aggregates which have heretofore been looked upon as unsatisfactory will find a place provided they are clean, structurally sound and properly graded. It would also seem that with proper cooperation engineers and architects could specify concrete of a given strength such a 2,000 lbs. or 3,000 lbs. and allow the contractor to use aggregates and mixes of proper proportions to produce with fair margin of safety concrete of the strength specified. Naturally tests will have to be made in advance, and studies made of the strength yield of concrete pro-

duced by wide variations in proportions and different aggregates, but it would surely be more satisfactory than using the old hard and fast rule of making concrete by proportions of 1: 2: 3 or 1: 3: 5 and guess whether the materials available will make concrete of desired strength and workability.

From the foregoing, which has been taken from good authorities on the subject, it has been shown that the hardness of aggregate has no bearing on the strength of concrete, and further that the per cent of wear of aggregate has only a slight bearing on the wear of concrete made therefrom, but in both instances the strength and wear of concrete are dependent on the quality of concrete. Quality is what counts and if our so termed "Scientific Concrete" will get quality, and unquestionably it will, why not have concrete made on a scientific basis at less cost, less worry and with better results to all.

In conclusion, the writer believes after making a study and investigation of the above data together with data which space does not permit incorporating in this article, that it will be to the advantage of every crushed stone aggregate producer to encourage the making of "Scientific Concrete" and to equip himself to produce scientifically prepared aggregates, for in this way our business can be raised to the level of those other interests cooperating in construction work in general; the engineer, the architects and the contractor.

The Bureau of Mines will ask of congress an appropriation of $90,000 this December for the purpose of establishing a plant in the field for the extraction of oil from shale on which the Bureau has been engaged for several years in laboratory experimentation.

Calcined dolomite should not be purchased as a substitute for lime in the cyanide process without a thorough investigation as to its action on the ore to be treated and its effect on all operations connected with plant practice.—Reports of Investigations, Department of the Interior, Bureau of Mines.

1923 Census of Cement Manufacturers

The Department of Commerce announces that, according to the data collected at the biennial census of manufacturers, 1923, the establishments engaged primarily in the manufacture of Portland, natural, puzzolan, and high-temperature cements in that year reported a total production valued at $285,050,551, an increase of 40 per cent as compared with $203,626,929 in 1921, the last preceding census year. The quantities and values of the principal products were as follows: Portland cement—137,460,238 barrels valued at $278,732,025, an average of $2.02 per barrel; natural and puzzolan cement —1,325,465 barrels valued at $2,061,894, an average of $1.55 per barrel.

Of the 138 establishments reporting for 1923, 23 were located in Pennsylvania, 14 in Michigan, 12 in New York, 9 in California, 8 in Kansas, 7 in Ohio, 6 in Alabama, 5 each in Illinois, Indiana, Iowa, Missouri and Texas, and the remaining 34 in 15 other states.

The statistics for 1923 and 1921 are summarized in the following statement. The figures for 1923 are preliminary and subject to such correction as may be found necessary upon further examination of the returns.

	1923	1921	Per cent of increase
Number of establishments	138	125	10.4
Wage earners (average number)	35,116	26,231	33.9
Maximum month	Aug. 37,462	Sept. 28,043	....
Minimum month	Jan. 31,138	Jan. 22,198	....
Per cent of maximum	83.1	79.2	....
Wages	$ 49,740,985	$ 34,415,677	44.5
Cost of materials (including fuel and containers)	$121,333,894	$102,359,637	18.5
Products, total value	$285,050,551	$203,626,929	40.0
Portland cement:			
Barrels	137,460,238	95,507,147	43.9
Value	$278,732,025	$180,778,415	54.2
Average value per barrel	$2.02	$1.89	....
Natural and puzzolan cement:			
Barrels	1,325,465	539,402	145.7
Value	$ 2,061,894	$ 897,025	129.9
Average value per barrel	$1.55	$1.66	....
All other products, value	$ 4,256,632	$ 21,951,489	—80.6
Value added by manufacture	$163,716,657	$101,267,292	61.7
Horsepower	644,038	.....	....
Coal consumed (tons of 2,000 lbs.)	8,444,609	.....	....

Vermarco Lime Company Producing Lime From Crystalline Marble

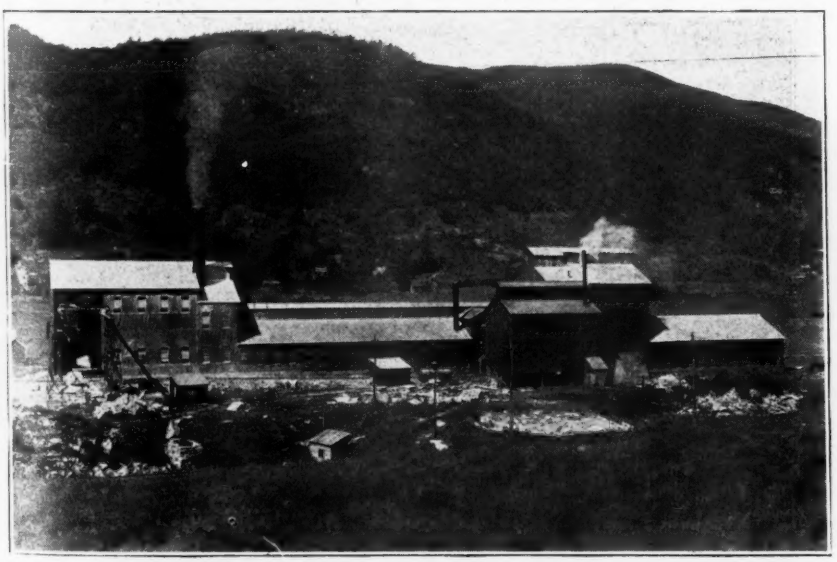
Wastes From Marble Quarry Utilized to Make High Grade Lime After Operating Eight Years Fuel Oil Adapted for Calcining

THE Vermarco Lime Company at West Rutland, Vermont, a subsidiary of the Vermont Marble Company of Proctor, Vermont, manufactures a high calcium lime, which is sold as quick lime and hydrated lime. The quick lime is in the granular form.

The plant is located one mile north of West Rutland village and has a siding off from the Delaware and Hudson Railroad. It also has connections at Proctor and Center Rutland with the Rutland Railroad through the Clarendon and Pittsford Railroad.

The stone used to make lime is crystalline marble of uniform purity, which is waste in the quarrying and sawing of the rock for the construction and monumental marble. It analyzes 98.5 per cent Calcium Carbonate and makes a very pure lime product, which is used successfully in the building trade as Masons' and Finishing Lime, and makes a very high grade chemical lime, also an agricultural lime which runs high in available oxides. Both the building and chemical limes are sold in the oxide and hydrate form; the agricultural, however, is all hydrated.

The stone is delivered by the Vermont Marble Company's engines from the marble quarries and mills to the Lime Plant on flat cars, from which it is either piled in storage or fed directly to the crushing plant. The primary breaker is a 48x60 inch Worthington Superior Jaw Crusher and is fed by a 25 ton Whiting Crane. This crusher weighs 105 tons and is operated by a 150 H.P. motor. The jaw crusher feeds directly into a number 6 McCully Gyratory crusher. When the mill waste is small enough to go to the gyratory crusher direct, the dump cars discharge to this crusher direct without the electric crane handling the material. The output of this crusher is passed through a series of elevators, screens, conveyors, double rollers and a hammer mill, until the final product of



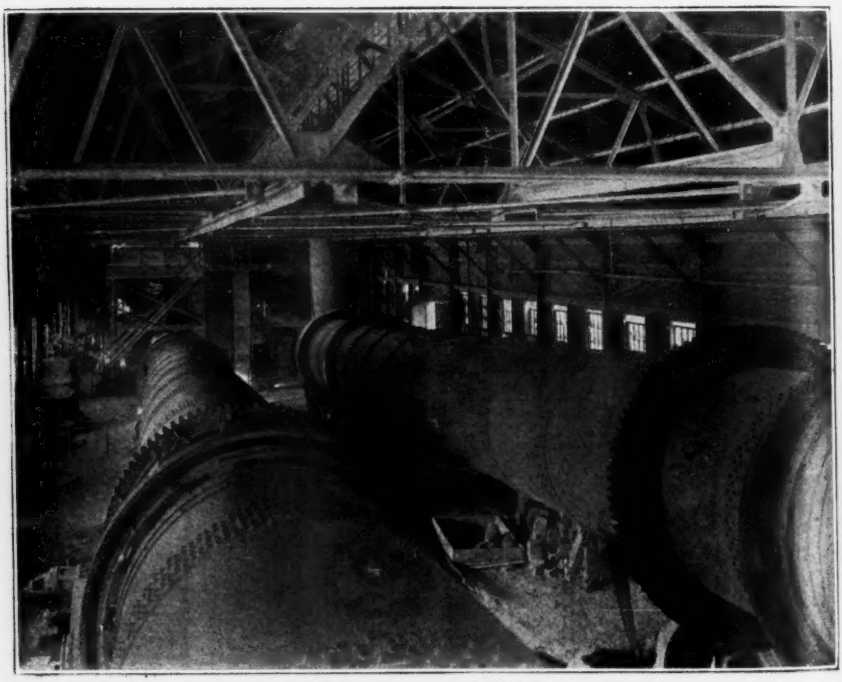
Lime Plant of the Vermarco Lime Company.

stone is in granular form, the size running from dust up to ⅛ inch in diameter. This output of the crushing plant is delivered by conveyors to either of two storage tanks, holding 300 and 400 tons each, or to two stock bins with a capacity of 100 tons each. The crushing equipment includes 36x16 inch Superior rolls and 24x12 inch Simplex crusher rolls. The conveyors, buckets, etc., were manufactured by the Stephens Adamson Manufacturing Company. The belting was furnished by the B. F. Goodrich Company. A hopper feeder takes the stone directly from the stock bins into the rotary kilns.

There are two Vulcan Rotary kilns, number 1 and number 2 each of which is 120 feet long, and 8 feet and 7 feet in diameter respectively. The kilns are lined the entire length with Crescent fire brick and are set on a slope of ⅝ of an inch to the foot. Both kilns are driven by variable speed motors, which give 13 different rates of kiln speed, ranging from one revolution in two minutes to one revolution in one and one-half minutes.

The stone is fed in at the high end of the kilns, or the "stack end" and heat is applied from the lower, or "lime discharge end." By the kiln rotation and gravity, the stone passes slowly from the stack end toward the lower end and is subjected to heat, which is just enough to break up the stone into calcium oxide and carbonic acid gas. This gas, with other gases from the fuel used, is carried up the 70 foot kiln stacks. A series of baffling walls in the stack chamber prevents the fine stone particles and lime from being drawn up the stack by the draft. Any of this material which collects at the base of the stack chamber is removed by a screw conveyor and carried to the original stone elevator and elevated to the stock bins from which it is again returned to the kilns.

The lime passes through chutes into coolers from the discharge end of the kilns. It takes three hours from the time the stone enters the kilns until the reaction is complete and the lime enters the coolers. Fuel oil of paraffin base is used to supply the heat, and is controlled by recording pyrometers, which register the temperature of the discharge gases just as they leave the kilns. This temper-



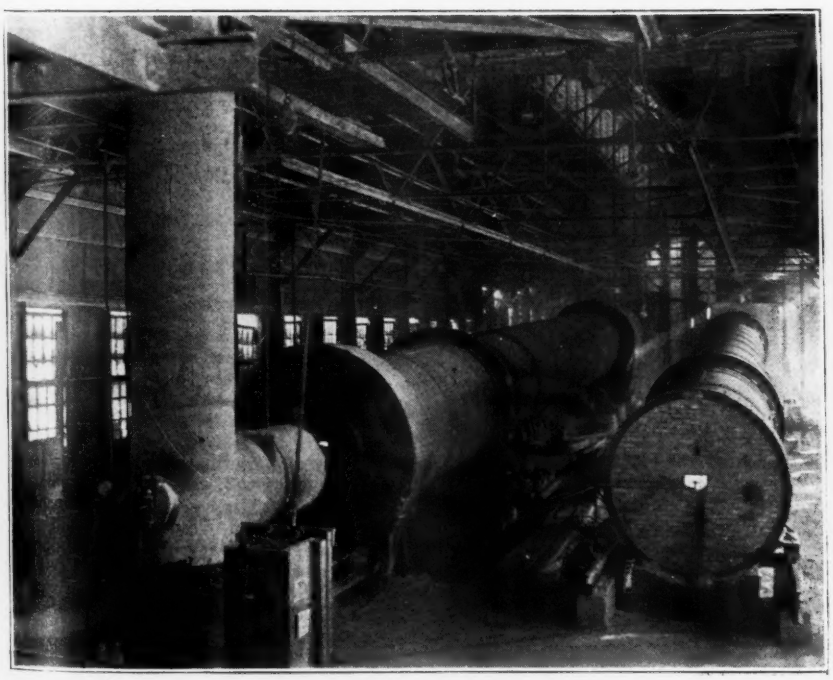
Rotary Kilns Looking Toward Discharge End.

ature ranges from 1,200° to 1,300° Fahrenheit. The fuel oil is atomized with steam in Best burners, producing a flame the full length of the kiln, and the steam used for atomization of the oil is furnished by a waste heat boiler, operated by the discharge gases from kiln number 2.

The coolers into which the lime from the kiln is discharged are below the kilns in the cooler pit. They are 50 feet long and 5 feet in diameter and serve two purposes. They cool the lime. A draft through the cooler is induced by the kiln stack and the burning process in the kiln and in this manner the air passing over the hot lime in the cooling process is preheated for the kilns. The coolers are pitched at the same angle as the kilns and each is driven by a 10 H.P. motor.

When the quick lime leaves the coolers, it goes into elevators, which discharge into three different steel storage bins with a capacity of 250 tons each. These bins are connected at the bottom to a Kritzer hydrator, weighing machines, and car loading spouts, so that the lime can be hydrated, barreled, or loaded in cars in bulk form.

The lime to be hydrated is taken from the bins by an elevator and delivered to the six-cylinder Kritzer hydrator made by the Kritzer Company, Chicago. This machine scientifically slakes the lime, adding the proper amount of water to exactly hydrate and yet have the product come out absolutely dry. The water is admitted in a spray to the stack of the hydrator, through which the heat generated by the chemical reaction is carried off, and this not only keeps the light hydrate from being drawn up the stack, but the water in turn is preheated, thus assisting the action of hydration. Revolving heaters or paddles assist the movement of lime and water through the series of six cylinders, thoroughly mixing the oxide with the water and insuring complete hydration and absolute drying, so that the material is discharged to a screw conveyor at the bottom as an impalpable flour. This passes to Raymond mills and beaters, where any core, unburned material or foreign substance of any kind is separated and discharged, permitting the pure white, fluffy hydrate to be raised in the air separators to the hydrate



Rear View of Kilns Showing Oil Burning.

storage bins, from which it is bagged by a Bates valve bagging machine. A dust-collecting system at the bagger removes the fine material that is spilled in bagging.

The large storage space available permits carrying a stock of from 1,500 to 2,000 tons of lime. In addition to the equipment described, there is a pulverized stone department which takes the crushed marble from the stone storage bins and with the aid of a Fuller mill reduces it to about 100 mesh product, suitable for agricultural limestone, as a paint and putty filler, etc., for which the demand is rapidly increasing. This product is elevated to storage bins, packed and shipped in a way similar to the lime products.

The company has its own cooperage shop, where most of the barrels used are manufactured. Some barrels with tongued and grooved staves and some steel drums are bought ready made. These barrels hold 280 pounds net of the quick lime.

Electricity, generated by the Vermont Marble Company's power plants, is used to operate the machines. The current comes from two different power stations, one line carrying 44,000 volts and the other 11,000. These are stepped down to 440 volts at the lime plant's sub-station. When one line is out of order, or is down for repairs, the second line can be used, thereby giving increased flexibility and continuance of operation. The current is alternating, 60 cycle and operates 28 motors, ranging in size from one H.P. to 150 H.P.

This plant has been in operation eight years, and has always used Producer Gas for calcining purposes instead of Fuel Oil, until the last six months. Kiln number 1 is still connected with a Chapman gas producer. The second Kiln, number 2, has just been installed this summer and was put into operation on the 27th of September.

A New Diesel Engine

A new design of two-cycle, double acting Diesel engine has been developed by the Worthington Pump and Machinery Corporation, New York City, which offers several advantages over existing types of internal combustion power machinery. The manufacturers claim that present indications are that horsepower per cylinder can be carried to a much higher value in the new engine than has yet been obtained in Diesel engines, thus making it an active competitor over a wider range of steam-power machinery than has been possible before with Diesel type power.

The new engine combines fuel and operating economy on a par with the best existing types of Diesel engines. The weight, dimensions and construction costs approach those of reciprocating steam machinery. The first unit built has been rated at 600 to 800 H.P. for a single cylinder unit at speeds of 90 to 120 r.p.m.

The cylinder design is the underlying principle of the engine. This is constructed so that every stroke is a power stroke, making its working cycle virtually the same as that of a reciprocating steam engine. The cylinder is composed of two single-acting cylinders, opposed end to end and working in opposite directions, their respective pistons flanged to the same rod, but ports, cooling system, and expansion provisions being independent of each other.

Reversal of running direction is accomplished by moving the reversing lever so as to move the cams through a 34 degree angle. Starting and stopping is also accomplished by a single lever, which operates the air-starting and fuel supply valves. The reversing and starting and stopping levers are interconnected so that the engine must be brought to a full stop before reversing. Three fuel spray valves are arranged to give uniform distribution of the charge around the piston rod. Each valve has a cam, all geared to a common shaft, which is connected by a worm shaft and oil-operated hydraulic mechanism, to the reversing lever.

Foote Bros. Announce:

The Foote Bros. Gear & Machine Co. of Chicago are now erecting a new addition to their plant with an entrance on Lake Street. The new building is to be used for shipping, receiving and raw material storage.

Among the many exhibits to be seen at the Grand Central Palace, New York City, at the National Exhibition of Power and Mechanical Engineering, December 1 to 6, will be an interesting display of Spur and Worm Gear Speed Reducers by Foote Bros. Gear & Machine Co. Demonstrations will be made as to the application of these compact, enclosed reduction units to industrial equipment.

The Economics of Rate Making

Written Expressly for PIT AND QUARRY by JOSEPH H. DONNELL.

III

This is the third of a series of articles on the economies of rates and rate structure. The first article appeared in the November 1st number of PIT AND QUARRY and discussed the elements affecting the carrier's cost of service. This discussion was continued in the second article that appeared in the November 15th number. The value of service and the volume movement of freight was also discussed in the second article.

Heretofore information and data on this subject have been scattered and inadequate. The question of rates is a vital one to the producer, and these articles will merit careful study.

—EDITOR.

PREVIOUS installments have dealt with the cost of service principle, value of service, volume and density of traffic and certain elements affecting their use as determinants of rates. We now approach another factor which plays a not inconsiderable role in the measuring of rates, viz., the character of the commodity. Commodity rates are special rates established to apply on specific commodities and are gauged to reflect the various conditions incident to the transportation of the particular commodities upon which they apply. The extent to which other principles may be applied to rate making is determined in large measure by the nature of the commodity, not only in connection with commodity rates, but with class rates as well.

When contrasting the movement of coal with dressed beef, it is at once apparent that beef by reason of its perishable nature and the special service and equipment which its carriage requires, involves higher transportation costs than coal, which is not perishable and which not only requires no special services but may move in open top equipment, thus reducing the carrier's cost of transporting it.

Also consider the relative values of these two commodities. Beef is more valuable than coal, and the value of the service performed is greater to the beef shipper than to the shipper of coal. Hence the cost of service and the value of service both warrant higher rates on beef.

Joseph H. Donnell

In contemplating the establishment of commodity rates or classification ratings on any commodity, the character of the commodity must be taken into account. This necessitates consideration being given to the following factors which are indissolubly related to the character of the commodity.

1. Bulk.
2. Weight per unit.
3. Density of loading.
4. Value per unit.
5. Hazard of handling or risk involved.
6. Stage of manufacture.
7. Ease of handling.
8. Liability to damage other articles or carrier's equipment.
9. Special equipment required.
10. Whether a necessity or a luxury.
11. Commodity relationships.

Let us study these factors separately and see just how they affect rates.

Bulk

The manner in which the bulk of a commodity affects its rates is readily discernible in the manner in which it affects the carriers' transportation costs.

A light and bulky article of irregular or awkward shape occupies more car space and weighs less than a heavy article of regular contour; hence the former is conducive to light loading and higher costs while the

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latter stows to greater advantage permitting heavier loading, lower costs and greater revenues. For these reasons the rates should be and usually are higher per hundred pounds or other unit on light and bulky articles than on heavy compact packages. Of the manner in which bulk and weight per unit affects rates the Commission has said in conection with cases involving typical commodities, "Flat cotton takes twice the car space necessary for compressed cotton" (46, I. C. C., 451). "If cotton is transported flat in order to meet freight requirements and convenience, resulting use of additional car space should be paid for by the shipper." (46, I. C. C., 451.)

Of wool the Commission said, "The wide variance between the loading of wool in sacks which is less than one half the possible loading of wool in machine pressed bales is a material factor to be considered in fixing a rating or a rate." (49, I. C. C., 656.) Of coke the Commission said, "Coke loads lighter than coal. Rates thereon should not be lower." (35, I. C. C., 497.) Other cases have developed information as to the relative loading capacities of scrap iron and finished articles made of iron. Thus "Average loading of scrap iron is about 50,000 pounds." (33, I. C. C., 668.) "Agricultural implements do not load much in excess of 20,000 pounds." (Garland & Orendorff vs. Illinois Central Railroad Company, 34, I. C. C., 90.)

Naturally for this and other reasons agricultural implements should be rated higher per hundred pounds than scrap iron. What is true of the above commodities is likewise true of many other commodities involving similar transportation conditions and characteristics.

Value Per Unit

In discussing this factor it is sufficient to say that the value of any article per hundred pounds or other unit is directly dependent on the nature of the article or the character of the commodity. The effect of the value of the commodity upon costs, value of service, and consequently upon rates, has already been discussed in detail in connection with "cost of service" and "value of service." However, three following quotations from decisions of the Interstate Commerce Commission are especially illustrative of the manner in which the value of an article affects its rates.

"Coal ashes, cinders and foundry dirt are articles of little or no intrinsic worth. Class rates applied were out of proportion to rates ordinarily applied on these articles." (Dupont de Nemours Powder Company vs. Pacific Railway Company, 30, I. C. C., 1.)

"Value and those things which connote value normally make for rates which may properly be higher than those on articles of lesser worth." (50, I. C. C., 62.)

"Inclusion of value of commodity as a determinant of the appropriate rate was intended to incorporate into theoretical rates a reflex of value of service to shipper as contrasted with cost of service to carrier." (35, I. C. C., 497.)

Hazard of Handling or Risk Involved

The risk involved in the transportation of a shipment varies with the nature of the commodity. The question of risk, of loss and damage has been discussed somewhat fully in connection with the cost of service principle; therefore, it need not be again discussed in detail. The reader should be reminded however that the greater the risk involved the greater the carrier's cost and liability for damage. This naturally results in higher rates on those articles which are susceptible to damage as in contrast with other commodities which are relatively free from susceptibility to damage in transit. Thus livestock, which is a very hazardous commodity, takes relatively high rates as compared with coal or lumber. Also liquids, which are very hazardous to handle in that they are not only subject to leakage but may damage other articles loaded in the same car, also take high rates as compared with solids. That the railroads' increased liability in connection with the handling of hazardous freight should be compensated by higher freight rates is evidenced by the following excerpts from decisions of the Inter-State Commerce Commission:

"Held that the rate on tea in bags had not been shown to be unreasonable since tea packed in bags was very susceptible to damage and might properly take a higher rate than tea in boxes." (Clossett & Zebers vs. M. P. Ry., 45, I. C. C., 99.) "Rates must be proportionate to risk assumed." (The Cummins Amendment, 33, I. C. C., 682.) "Risk in the movement of plate glass is much greater than that of common window glass. Rate not found unreasonable."

(Belknap Glass Co. vs. G. N. Ry., 33, I. C. C., 322.) "Evidence indicates that stearine in bags is less desirable and a more hazardous article of commerce than stearine in barrels, and should be rated somewhat higher." (Lookout Refining Company vs. L. & N. Ry. Co., 36, I. C. C., 167.)

Stage of Manufacture

In connection with certain commodities the several stages or processes of manufacture may affect the rate. The nature of the commodity from a transportation standpoint depends in large measure upon the particular stage of manufacture in which it is found when tendered to the railroad company for transportation. In a previous chapter in connection with a discussion of the value of service, it was shown how iron ore may be made into pig iron, thence converted into sheet iron, and subsequently into wire and watch springs. It was shown why the rates on watch springs should be higher than on sheet iron or iron ore. This illustration set forth the manner in which the stage of manufacture affected the cost of service, the value of the commodity, the value of the service, and the risk of handling; consequently how rates might well vary on these various articles.

It may be accepted as a fact that ordinarily rates on raw material are lower than on finished products. This is not always true however. In a case brought before the Interstate Commerce Commission by the Chamber of Commerce in Houston, Texas, against the Southern Pacific Company (49, I. C. C., 316), the Commission said, "The rule that rates on raw materials should not exceed those on the manufactured products is not universal in its application." Thus it may be seen that there are exceptions to this general rule.

Ease of Handling

The weight and bulk of a shipment contributes either to the ease or difficulty of handling it. Heavy, bulky articles are hard to handle and light, compact articles are easy to handle. The Commission has said in effect that carriers are entitled to compensation for extraordinary difficulty encountered in handling shipments due to unusual bulk and weight. Thus in its reports, (33, I. C. C., 378), it said: "Loading of extra long or bulky shipments entails much unusual handling which adds to the expense of the carriers."

Special Equipment Required

The nature of the commodity determines whether or not ordinary car equipment may be used or whether special equipment will be necessary to its transportation. Thus perishables which require refrigeration require refrigerator cars for their safe transport, and the carrier may exact a higher rate for the transportation of such commodities in order to offset its higher costs. For example, live poultry must move in special equipment and livestock also. Oil, molasses, vinegar, acids of different kinds must move in tank cars. On this subject the Commission has said: "A charge for furnishing refrigerator cars is not unreasonable." (50, I. C. C., 324.) Again the Commission says, "The Commission frequently considers in determining the reasonableness of rates the equipment furnished." (18, I. C. C., 522.)

Necessity or Luxury

The character of a commodity also determines whether it is a necessity or a luxury. Necessities are frequently low grade articles. Luxuries are frequently, in fact usually, articles of high grade. Ordinarily lumber and coal are necessities, whereas silks, satins and delicate fabrics are usually luxuries. The cost of service in connection with low grade articles is usually lower than in connection with high grade articles. Similarly the value of the service in connection with the former is less. Claims for damage are not nearly so numerous in connection with low grade articles as in connection with high grade articles. For these reasons the rates on necessities are as a rule lower than the rates on luxuries, and properly so. It should also be mentioned that necessities move in much greater volume than luxuries, and the carriers in large measure depend upon the transportation of the necessities of life for the bulk of their revenue. What has been said must not be construed to mean that the use to which a commodity is to be put can be accepted as the basis for determining the rates applicable thereon. The Commission has specifically ruled that rates may not be predicated upon the use to which a commodity is to be put. Thus rates on necessities are lower than on luxuries not because they are necessities but because of their transportation characteristics.

Commodity Relationship

The character of a commodity al-

ways determines the relationship of one commodity to another. It is frequently the case that the rates on certain commodities are made with relation to the rates on other commodities somewhat similar from a transportation standpoint. Excerpts from the decisions of the Commission are very illustrative of why this should be and cites specific commodities. "Sash and doors rates should show a fixed relation to lumber rates." (33, I. C. C., 332.) "Rates on Toasted Wheat, Biscuit and Krumbles not in excess of rates on Cream of Wheat, Post Tavern Porridge, and like uncooked cereal breakfast foods prescribed." (Kellogg Toasted Corn Flake Co. vs. A. T. & S. F. R. R. Co., 33, I. C. C., 534.) "In no case should rates on cottonwood and gum, or other hardwood, exceed rates on yellow pine." (Rates on Lumber from Southern points, 34, I. C. C., 652.) "Lumber trimmings said to be analogous to fuel wood. The rate is reduced to 80% of the lumber rate." (Unreported opinion No. 1962.) The character of the commodity usually affects individual rates rather than general rate levels, except in some cases where the extraordinarily heavy volume of movement of a particular commodity may form a preponderance of the tonnage carried, in which case the low rates upon that particular commodity may tend to have the effect of lowering the general rate level. One of the outstanding features in connection with the character of the commodity is that it is intimately related to practically all other principles of rate construction. In fact, it may be said that practically all of the other elements of rate making depend in large measure upon the character of the commodity.

Railway Competition

Practically all traffic moving over the railroads of this country is competitive, the only exception being in connection with local traffic which moves only over one line of railroad. The United States today is a veritable network of railway lines induced by the rapid settlement of the country and the consequent expansion of business. Practically all long-haul traffic may move over optional routes. Thus the element of competition between railroads has entered into and has exercised a potent effect upon rate structure.

Practically all rates reflect a spread between the cost of service and the value of service. The measure of this spread is largely influenced by railroad competition. As a general rule rates between common points over competitive lines are the same by all lines competing for the traffic. Thus it would seem that competition is found in connection with service rather than in connection with rates. That railway competition does effect the level of rates, however, cannot be denied. In territories served only by one railroad it is generally true that the rates will be found to be higher than in other territories served by two or more roads.

On traffic moving between two given points, assuming that the service via optional routes is of equal quality, the shipper would naturally select the route affording the lowest basis of transportation charge. The rates being equal, the shipper would on the other hand select the route giving the best service.

In the early days of railroading, prior to the enactment of the Interstate Commerce Act, disastrous rate wars between carriers were not infrequent. There also came into being the deplorable practice of rebating. This practice consisted of the railroad's charging the shipper the published rate and then refunding or rebating to the shipper a certain proportion of the freight charges paid on that shipper's traffic. The practice of rebating which became very general was an economic evil of no little importance. It favored the big and financially strong railroads to the detriment of the smaller or financially weak roads. Similarly it was employed in the interest of large shippers to the corresponding disadvantage of the smaller shipper. Thus, a financially strong railroad could afford to give bigger rebates than its weaker competitor, and the large shipper could through its greater amount of tonnage induce larger rebate than the smaller shipper, having a smaller volume of tonnage. Thus, the strong roads and shippers became stronger at the expense of the financially weak roads and the small shippers. The rebating evil not only stifled competition between railroads, but it also enabled the big manufacturer and the big shipper to undersell and thus stifle competition of his weaker competitors. Finally, the act to regulate commerce was enacted to put a stop to this nefarious practice. The railroads today abide by the published tariff rates which are avail-

able to all shippers, whether large or small. The law which ended rebating likewise put a stop to discriminatory practices, wherein a carrier was enabled to give preferred service to one shipper, while denying the same service to another. Of the rebating practice the Interstate Commerce Commission said, "The act to regulate commerce imposes upon carriers the obligation to establish and maintain just and reasonable rates and it prohibits the granting of rebates or concessions from or offsets against the established rates whereby interstate shipments shall by any device be transported at less than the lawfully established rate, or whereby any advantage is given or discrimination is practiced among shippers. Although published rates may be collected on shipments transported, concessions and offsets may be extended by the carriers or the interests who control the carriers to favored shippers. These concessions and offsets are as pernicious as direct rebates and it matters little whether they are in the form of cash payments, interest charges, royalty earnings, use of valuable property at inadequate rental, the free use of the carrier's plant or credit, or other insidious means, if they confer concessions and advantages which place certain shippers in a position of preference and advantage over competitors who are also customers of the carrier." (Rates for transportation of Anthracite Coal, 35, I. C. C., 220.)

The competition between industries is in many respects very different from competition between railroads. That competition between railroads in rate matters is sometimes inimical to the public interest is very aptly illustrated by Dr. Hadley of Yale University in his book on "Railroad Transportation" wherein he says, "There is a marked difference of principle between mercantile competition and the competition of railroads. In the former case its action is prompt and helpful and does not go to extremes. If Grocer A sells goods below cost, Grocer B need not follow him, but simply stop selling for the time. For this involves no great present loss to B; when his receipts stop, most of his expenses stop also. It does involve a present loss to A. If he is selling below cost, he loses more money the more business he does. It cannot continue indefinitely. If A returns to paying prices, B can again compete. If A continues to do business at a loss, he will become bankrupt, and B will find the field clear again. But if Railroad A reduces charges on competitive business, Railroad B must follow. It involves a great present loss to stop. If a railroad's business shrinks to almost nothing, a large part of its expenses run on just the same. Interest charges accumulate. Office expenses cannot be suddenly contracted. The repairs do not stop when the traffic shrinks, for they are rendered necessary by weather as well as by wear. If B abandons the business, A's reduction of rates will prove no loss. The expense of a large business is proportionately less than that of a small one. A rate which was below cost on 100,000 tons may be a paying one on 200,000 tons. Porfitable or not, A's competition may be kept up indefinitely. The property may go into bankruptcy, but the railroad stays where it is. It only becomes a more reckless and irresponsible competitor. The competition of different stores finds a natural limit. It brings rates down near to cost of service and then stops. The competition of railroads finds no such natural limit. Wherever there is a large permanent investment and large fixed charges, competition brings rates down below cost of service. The competitive business gives no money to pay repairs or interest. Sometimes the money to pay for these things comes out of the pockets of other customers who do not enjoy the benefit of the competition and are charged much higher rates. Then we have the worst forms of discrimination. Sometimes the money cannot be obtained from any customers at all. Then we have bankruptcy, ruin to the investor, and when these things happen on a large scale a commercial crisis."

On the other hand competition in service between railroads is a stimulant to better service and may therefore be considered in the public interest. The carriers, in competition for certain traffic upon which the rates are equal via all lines, must in large measure rely upon the character of the service offered in order to induce the movement of the tonnage via their respective lines. Thus competition in service results in superior equipment being made available for shipper's use, and also insures the expediting of shipments as well as careful handling in transit. Competition of this character works out to

the advantage of the carriers themselves for the reason that expedited shipments have the effect of releasing cars more promptly than might otherwise be the case, and these cars may then be used in other movements. The carriers' earnings from investments in cars will vary with the amount of transportation that the cars are made to perform.

Competition in service between railroads frequently has the effect of increasing costs. A carrier may by reason of keen competition be compelled to render some special service which would otherwise be unnecessary in order to induce tonnage. It thus adds to its transportation cost. That is, the cost is inreased unless the special service results in a sufficiently increased volume of traffic to more than offset the increased cost and to show a larger net profit per unit. In other words a carrier's transportation costs decrease with an increasing volume of tonnage. Railroad traffic managers are confronted with the necessity of building up a large volume of tonnage. They must hold the traffic which gravitates to them and through solicitation increase the volume as much as possible. Frequently, in the case of several railroads competing for tonnage moving between two given points, one of the lines will have a more or less circuitous route as compared with a more direct route. Ordinarily from the standpoint of distance traversed the rates via the indirect line would be higher than via the short line. However, if indeed the rates were higher via the long line, it may be accepted that the short line would secure the preponderance of the traffic, thus eliminating the longer line from competition. In order to meet this situation the Interstate Commerce Commission in the majority of instances allows the long line to meet the short line rates to the competitive destination. This sometimes results in rates to a competitive destination being lower than rates to intermediate non-competitive local stations on the line of the circuitous route. Such situation as this may exist only by virtue of special authority granted by the Interstate Commerce Commission to the longer line authorizing it to maintain higher rates to intermediate points than to destinations beyond on the same line or route. These cases are known as "fourth section departures." That is, they depart from the provision of the fourth section of the Interstate Commerce Act which specifically prohibits the establishment of higher rates to intermediate points than to destinations beyond, except in such cases as may be specifically authorized by the Interstate Commerce Commission. The Interstate Commerce Commission not only permits fourth section departures in cases of circuitous lines vs. direct lines, but also frequently permits such departures in order to enable rail carriers to meet water competition at points served by both rail and water lines.

In this connection it is appropriate to mention the fact that there has been a great deal of agitation for a so-called rigid long and short haul clause, as in contrast to the more or less flexible clause now in use. The rigid clause as contemplated by its adherents would absolutely prevent fourth section departures in cases involving water competition. This would have the effect of placing the rail carriers at a serious disadvantage, as in many cases to decrease their rates to intermediate stations to the same level of the rates of points beyond would render the traffic unremunerative and compel them absolutely to abandon competition with the water carriers. Under a flexible long and short haul clause a carrier may shrink its profits to a competitive destination depending in large measure upon its revenues in connection with traffic to intermediate points to offset the shrinkage in its earnings on traffic to competitive destinations. Some of the expressions of the Interstate Commerce Commission manifested in decisions which they have handed down from time to time are very illustrative of their attitude on the subject of fourth section departures. For example, in the case of Dewey Bros. Company vs. the P. C. C. & St. L. Ry. (46, I. C. C., 388), the Commission said, "The fourth section was intended to restrain carriers from continuing lower rates to more distant points except in special cases where relief from the long and short haul requirements is afforded by the Commission. Such relief has been granted in cases where competition of water lines is strong, and where carriers operate circuitous routes in competition with direct lines." In another case (City of Memphis vs. C. R. I. & P. Ry. Co., 43, I. C. C., 124), the Commission said, "In establishing rates between Memphis and certain points in Arkansas based on distance,

the shortest workable route whether over two or more lines should be used. The carriers having circuitous routes, however, may meet the short line rate to common points while carrying higher rates to intermediate points provided these rates are made up on a distance scale and provided the lowest combination is not exceeded." In connection with this last decision it will be noted that the Commission prescribes that rates based upon the lowest combination available should be observed as maxima. The Commission has also held in connection with relief from the long and short haul clause that circuitous routes must not be excessively longer than the direct line or involve unreasonably long hauls considered in the light of the compensation received. This is largely for the benefit of the carriers and protects their revenues against unreasonable depletion.

For example in the C. F. A. Class Scale Case (46, I. C. C., 475), the Commission said, "Departures cannot be countenanced in any case where the carriers by excessively circuitous routes undertake to meet rates of the short route, and if it later appears that carriers continue rates via such routes in contravention of the fourth section, appropriate orders of denial will be entered." Again the Commission said, "Distance via the circuitous route from Fort Wayne, Indiana, to Lima, Ohio, is 150% greater than the direct line. Relief will be denied as departures cannot be countenanced where carriers by excessively circuitous routes undertake to meet rates of the short routes." (C. F. A. Class Scale Case, 46, I. C. C., 475.)

The Commission has also held that the disparity in rates to the intermediate points and to the competitive destinations beyond may not be too great. For example, in a case involving rates between Central Freight Association territory on one hand and C. & O. Ry. points on the other (47, I. C. C., 576), the Commission said, "Rates on any commodity to or from any intermediate point shall not exceed the rate on the same commodity to or from the next more distant point, to or from which the lower rate is charged by a greater amount than the rate, to or from the intermediate points on the class to which the commodity belongs, exceeds the rate on the corresponding class to or from the more distant point."

Thus it will be seen that while many conditions and circumstances may justify in certain cases fourth section relief being granted to a carrier, nevertheless this relief must be granted within reasonable bounds.

In the past the Commission has had occasion to pass upon rates to points intermediate to some point beyond, enjoying a lower rate, but located on another line of railroad. The Commission has in such cases held that the points in question being on other lines involved no violation of the fourth section and that reductions in rates to the intermediate points located on other railroads would have to be based upon conclusions of unreasonableness induced by some cause other than fourth section violation.

Thus in a case brought before the Commission by Sunderland Bros. Company against the M. P. Ry. (45, I. C. C., 193), the Commission said, "As the lower rate in effect from the farther distant point does not apply over the route of movement, the rate charged does not involve any departure from or violation of the fourth section."

The following excerpts from decisions of the Commission are very informative. "The essential justification for lower rates to a more distant point than to an intermediate point is the existence at the more distant point of depressed rates which the carrier is powerless to effect, and failure to meet which would prevent the carrier from participating in the traffic to the more distant point." (Transcontinental Rate, 46, I. C. C., 236.)

Carrier competition often has the effect of influencing entire rate structure. The Missouri River Rate structure is an excellent example of a rate level depressed by carrier competition. This fact has been recognized by the Interstate Commerce Commission in many cases which have come before it for adjudication. Thus, in 44, I. C. C., 727, the Commission said, "Class and commodity rates from New Orleans to Kansas City are influenced by water competition." Again the Commission said, "Carrier competition has played an important part in rates from New Orleans to Missouri River cities and is today the predominating influence in the situation." (44, I. C. C., 727.)

In a case involving rates on grain and grain products (33, I. C. C., 374),

the Commission said, "Proportional rates between Kansas City and Omaha and points in Iowa and Minnesota are depressed because of intense railway competition." In another case, brought before the Commission by the Tulsa Traffic Association against the Sante Fe Railway (40, I. C. C., 9), the Commission said, "Kansas City is so situated with reference to Chicago and St. Louis and carrier competition in traffic to and from those trade centers was and is so keen that it has been accorded comparatively low rates." In connection with rates to New York City, the Commission says, "Competition has brought to a common level the rates of transportation published by all of the carriers serving the port of New York." (47, I. C. C., 323.)

It should be borne in mind that circuitous carriers or routes cannot be compelled to meet short line competition. To compel a long line to meet the rates of a short line upon an unremunerative basis as measured by cost of service would violate the provisions of the Constitution. The Constitution insures the protection of property rights and prohibits the confiscation of property. To compel a carrier to haul traffic at a loss would be equivalent to a confiscation of the carrier's property. Therefore a carrier may elect as to whether or not it will meet lower rates via other lines in order to participate in traffic between competitive points. In this connection two excerpts from decisions of the Interstate Commerce Commission are authoritative and very illuminative. In the case of the Coffeyville Mercantile Co. vs. the M. K. & T. R. R. Co. (33, I. C. C., 122), the Commission said, "Where the short line carrier makes a rate, other carriers must meet that rate if they are to participate in the traffic." In Duran & Co. vs. the M. C. & St. L. R. R. (33, I. C. C., 523), the Commission said, "Carrier may so long as it does not unjustly discriminate between shippers or localities determine for itself the extent to which competition of other lines will be recognized in the conduct of its own business." Again the Commission said, "It is within the option of the longer line either to meet the rate of the shorter line or to retire from participation in the traffic." (Bituminous Coal Rate, to the South East, 37, I. C. C., 652.)

The following outstanding conclusions should be drawn from the foregoing. There is a very real competition existing between railroads. This railroad competition does affect individual rates, and rate structures. Carriers may or may not, at their own option, elect to meet competition in rates on traffic moving via a shorter line. The Interstate Commerce Commission recognizes that carrier competition should result in lower rates. Unbridled competition in rates is undesirable from the standpoint of the public interest, but reasonable rate competition under regulation is not undesirable. Railroad competition in service is for the public benefit, and frequently for the benefit of the carriers themselves. In this connection it may be mentioned that the beneficial effects of competition between carriers is one of the principal arguments against government ownership of railroads. It has been argued and properly so that government ownership of public utilities, especially transportation companies, would in large measure remove every vestige of competition as well as do away with personal incentive on the part of the railway employees.

Other forms of competition such as market competition, water competition, commercial competition and the legal factors of rate making will be discussed in subsequent installments.

The Hill Clutch Machine and Foundry Co.

Although what was formerly known as The Hill Clutch Co. of Cleveland, has been changed to The Hill Clutch Machine & Foundry Co., it is stated that no reorganization of this concern has taken place. This change in name has been made in order "simply to correct an erroneous impression, and more thoroughly acquaint the trade with the fact that we build 'not only friction clutches' but a complete line of Automatic Belt Tighteners, Special Machinery of all kinds, Fine Gray Iron Castings, and Gear Speed Transformers."

Hill Clutches, according to this company's circular No. 21, do a lot of easy work, and their performance is noteworthy then for reliability, economy and long life. They are also called upon to do some very hard work, under trying conditions.

An Unusually Efficient Canadian Crushed Stone Plant

Hagersville Crushed Stone Company Has Efficient Plant Producing 1500 Tons Daily, Largely for Railroad Ballast

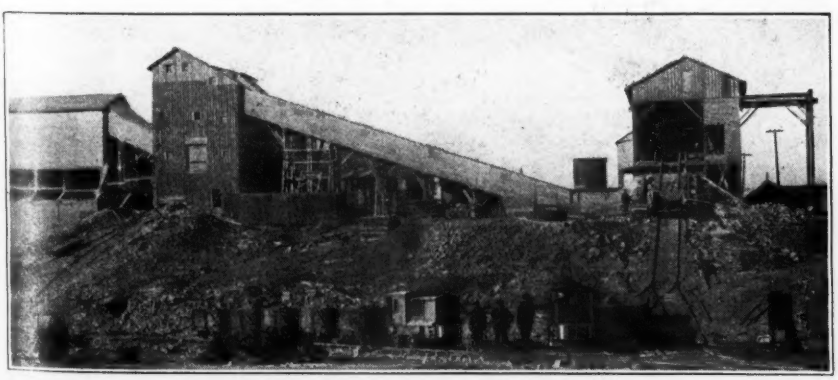
THERE are two important crushed stone plants in Hagersville, Ontario. The Hagersville Contracting Company has a quarry producing 1,000 tons daily about one-half a mile from the center of Hagersville. This quarry was opened in the early nineties, but the first crusher was not installed until 1901. From 1901 until 1919 it was operated continuously by a Mr. J. C. Ingles as president and general manager. In 1919 the Canada Crushed Stone Corporation Limited of Dundas took over the property and has been operating it ever since.

The Hagersville Crushed Stone Limited also operates a quarry at Hagersville. The plant is well situated with reference to the market. It has direct connections with both the Canadian National Railway and the Michigan Central Railroad. Connections are made through the Michigan Central Railroad with the T. H. & B: C. P. R.: R. M.: L. E. & N.: L. & P. S.; N. St. C. & T. and C. W. & L. E. railways.

About seventy per cent of the output is contracted for by the Michigan Central Railroad for use as railroad ballast. The balance of the output is distributed through the commercial market. This market is in South Eastern Ontario from Windsor to Niagara Falls, south to the lake with a reasonable freight rate as far north as Toronto.

Early in 1923 the present company bought the site which previously had been operated as a quarry and then abandoned. The present plant has only been in operation some eighteen months but continuous production of 1,500 tons daily has been maintained. The success of this plant is due to several factors. In the first place the stone produced has an enviable reputation for its many excellent qualities. The market is easily served. The officials responsible for the plant operation have selected modern and efficient equipment. All phases of the operations are constantly watched, and improvements made whenever advisable. These facts are probably the outstanding reasons for the success.

There is only about two feet of overburden on an average. This overburden was stripped from the present working face by scrapers and teams. Drilling is handled by two electrically operated Sanderson Cyclone drills. The holes are drilled 10 foot centers, staggered and loaded with 50 pounds of 40 per cent dynamite. Cordeau Bickford fuse is used. With this fuse the cap and detonation are on top thus insuring no after blast in the event of misfire. As many as 150



A Pit View Showing Incline and Crusher Buildings.

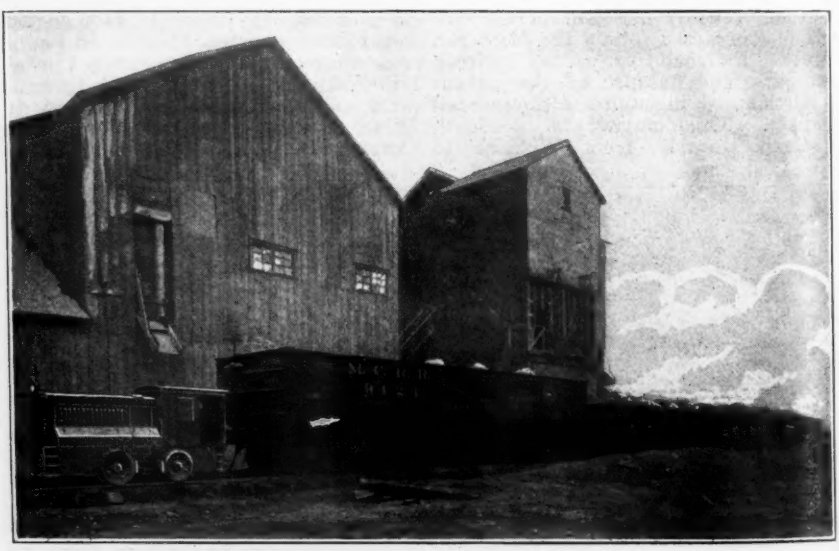
holes have been fired at one time as it is the practice to shoot the whole face at one time. An Ingersoll Rand air operated tripod drill is used for drilling when a small area is blasted. At the present time a 13 foot face is being worked. The pit is being worked in a circle.

A Marion 2½ yard number 80 railroad type steam shovel is used for most of the digging. Two ¾ yard Erie type B revolving shovels on traction wheels are used in cleaning up and working in the corners. The shovels load 6 ton capacity special end dumping steel cars. These cars are hauled in trains of 7 cars to a cable incline to the crushing plant. Three Plymouth gasoline locomotives are used in hauling the trains of cars. With the seven cars, each locomotive hauls about 40 tons. By using three locomotives there is always a train of empties to load and the shovel need not be idle a minute. Neither is there occasion for a train to wait more than two or three minutes for the train being loaded to pull away from the shovel during each trip. It is better by far to have a string of cars waiting a minute or two and have continuous production from the crushers than to have the shovel waiting for the cars and possibly the crushers in need of stone. A track of light rails on wood ties runs around the circumference of the pit. This arrangement reduces the switching to a minimum. The three locomotives and twenty cars handle the output of the shovels easily. One of the three locomotives is also used for spotting railroad cars for loading.

The loaded quarry cars are pulled up the incline by a cable and dumped into a McCully number 30 gyratory crusher, set with a 7 inch opening. The cable for hauling the cars out of the pit is electrically operated and capable of handling a car a minute. The end of the car is lifted by a tripping rail and as the car reaches the crusher it is dumped. The empty car returns down the incline to the pit by gravity.

The pieces of rock too large for the McCully primary crusher are sand blasted in the steel quarry cars. The stone from the primary crusher is carried by belt conveyor to a scalping screen with 2½ inch openings. The oversize is crushed in an Austin gyratory number 7 crusher with a 2½ inch opening. From the number 7 Austin crusher the crushed stone is elevated by a bucket conveyor to a second scalping screen. The oversize from this screen is crushed in an Austin number 5 gyratory crusher.

The number 5 Austin crusher discharges into the same conveyor used by the other two crushers. All material must pass the second scalping



Locomotive Spotting Cars For Loading.

screen. From the scalping screens the stone passes to the sorting screen. This screen has 1¾, 1 and ½ inch openings. Material passing the ½ inch screen is marketed as ⅜ inch stone and dust. The material passes from the screens to the separate storage bins.

An underground belt conveyor under the bins reclaims the material through bin gates and carries it to a bucket elevator which discharges to receiving hoppers. Cars are then loaded from these receiving hoppers by chutes.

Stock piles permit an additional 40,000 tons of storage. These stock piles assume their largest proportions during the winter. The stock piles are served by a 200 car track. A Marion number 28 clamshell bucket reclaims the stone. The ballast pile was built up by dumping from the track and as the pile increases in height the track is raised. The classified storage piles were built up by unloading the material and piling with the Marion clamshell.

When a Plymouth gasolene locomotive can be spared from the pit, it is used in spotting and switching railroad cars for loading. Usually all this work is handled by a steam locomotive purchased from the Michigan Central Railroad.

The shovels and the switching engine are steam operated. The quarry locomotives are gasolene driven. The balance of the plant is electrically operated. Water for the steam shovels is stored in a tank which is kept full by a 3 H.P. electric pump delivering from a well. A 6 inch centrifugal pump keeps the pit dry.

A force of 90 men working 11 hours daily handles the production during the season. During the winter this force is usually reduced to 40 or 50 men and the working day reduced to 9 hours. About two-thirds of the men live in Hagersville while the balance live in a camp built by the company.

The plant was designed by Frank M. Welch, chief engineer of the Greenville Gravel Company of Greenville, Ohio. Mr. F. B. Marble is president and general manager of the company. Mr. W. E. Rowe is secretary and treasurer. Mr. A. J. Sanderson is superintendent of the plant and Mr. C. E. Beard is assistant superintendent.

E C & M Co. Bulletin

Bulletin No. 1047, recently issued by The Electric Controller and Mfg. Co. of Cleveland, Ohio, describes E C & M Automatic High-Voltage Compensator for A. C. Squirrel-Cage Motors, with illustrations.

The E C & M Automatic High-Voltage Compensator is used for automatically starting 2,300 volt squirrel-cage induction motors, taking the place of the hand-operated starting compensator which has been considered the weak link in a high-voltage motor installation on account of the ever-present danger of injury to the operator due to oil-switch explosions, and the timidity of workmen in handling high-voltage apparatus.

The advantages claimed are economy of power, low-voltage control which makes starting and stopping easy, and the fact that no skill or experience are required. With the bulletin are also a Net Price Sheet and a Bulletin Index.

Glauser Joins Hyman-Michaels Company

The Hyman-Michaels Company of Chicago announces the addition to its personnel of F. W. Glauser, as the result of the expansion of this concern in the Railway Equipment Field and to serve better its growing clientele. Mr. Glauser will be located in St. Louis where he will assume the management of the Equipment Department for the Southern territory.

Mr. Glauser, who was formerly associated with the Mid-Continent Equipment & Machinery Co. of St. Louis, has a wide experience in Railroad work and his association with the Hyman-Michaels Company adds greatly to their facilities for serving the Railway Equipment Field.

Mr. W. P. Carmichael will retire from the sand and gravel business, but it is reported that he will give special attention to the extensive contracting work being done by his firm the Carmichael-Cryder Company, St. Louis, Missouri.

Mr. E. Guy Sutton and Mr. F. P. Steinberg, formerly with the Carmichael Gravel Company, will be officially connected with the Neal Gravel Company which firm will continue to conduct its business from its offices at Mattoon, Illinois.

Car Loadings Break Records

National Sand and Gravel Association Issues Figures. Ninth Annual Convention Held in Chicago Next Month

By Our Washington Correspondent

CAR LOADINGS of sand and gravel for the first part of the present calendar year have broken all records, according to reports to the National Sand and Gravel Association. The latest open top car figures announced by the American Railway Association are for the week ended November 1. These show total loadings of 58,758 cars of sand, gravel and stone, a decrease of 2,781 cars compared with the preceding week, a natural seasonal decline. It is, however, and increase of 10,108 cars over the corresponding week of 1923, and an increase of 20,976 cars over the corresponding week of 1922.

The total loading of sand, gravel and stone during September, 1924, was 246,516 cars, which is the highest month's loading in the history of the industry. October, 1924, with a total loading of 242,770 cars, established the second highest record. The loading of sand, gravel and stone during September and October of this year exceeded by over 60,000 cars the loading for the same months of 1923, which had set the record for the industry up to the beginning of 1924. A noteworthy fact is that loadings of sand, gravel and stone during September and October, 1924, have averaged more than 60,000 cars weekly, a figure which had never been reached prior to the beginning of this year.

But added to this is information given out by the association headquarters here that indications are winter building will be heavy and that the material market is reported active. Regarding prospects for winter building, the association draws its conclusion from the fact that total valuation of building permits for 210 leading cities of the country during October is $292,370,116. This is a 7 per cent gain over figures for October of last year, and a substantial gain over September of this year. It is pointed out that the first ten months of this year have piled up a record in building permits issued that would have seemed amazing five years ago, and more amazing in the years before the war. All authorities agree that winter construction this year will be on a greater scale than ever before, the association says.

Relative to activity of the market, the association finds this statement in "The American Contractor":

"On the whole, everyone is busy and the material markets are firm. Contracts for great tonnages of steel and stone for the larger structures are being let, and this fact gives the impression that an unusual volume of work is being planned for this winter. Although quarry operations have for the most part stopped, stone dealers are going into the winter with great stocks of cut stone to supply the needs of their customers, while the stocking of sand and gravel continues. Clay products plants are running full blast."

Secretary Barrows has telegraphed Washington headquarters, from Terre Haute, Ind., as follows:

"Another successful open meeting of the Executive Committee of the National Association was held at Terre Haute, Ind., on Tuesday, November 18. Sixteen men interested in the production of sand and gravel sat around a luncheon table at the Hotel Deming and there discussed intimately some of the everyday problems of this industry, with an exchange of suggestions as to the best means of solving these problems. As has been the experience in the other open meetings held in various districts, the time was pleasantly and profitably spent. The Executive Committee, encouraged by the direct and beneficial results of the Terre Haute meeting, is planning to continue the policy of holding open meetings. E. Guy Sutton, as director of the district in which the meeting was held, presided at the luncheon meeting. There was an executive session of the committee before and after the luncheon."

Plans for the Ninth Annual Convention in Chicago next month are going rapidly forward. November 20 the convention committee met in Chicago at the office of the Chicago Gravel Company. Those in attendance were: Chairman, T. E. McGrath, F. W. Renwick, R. C. Fletcher and V. O. Johnston.

The aim of the committee is to make the convention supreme in the point of real service and benefit to the sand and gravel industry. With this purpose as a foundation, plans have been laid for discussions of every phase of the business, the discussion being led by men in official positions and by producers.

Annual Cement Association Meeting, Cement Centennial Observed

THE Portland Cement Association concluded with a banquet Wednesday evening, November 19th, its usual annual meeting. Three days were devoted to the various sessions. On Monday, November 17th, reports of Standing Committees were prepared. On Tuesday, November 18th, the morning and afternoon sessions were given over to the usual program of reading and discussing specially prepared papers on cement mill practice. The subjects presented and discussed were the following:

"Fire Prevention and Cement," by R. S. Moulton, Assistant Secretary, National Fire Protection Association.

"The Economic Limit and Operating Flexibility of Waste Heat Boiler Installations," by Helmuth Krarup, Superintendent, Hawkeye Portland Cement Company.

"High Early Strength Cements," by Dr. Gustav Haegermann, Director, German Portland Cement Association Laboratory.

"European Cement Plant Practice," by H. A. Schaffer, Conservation Engineer, Portland Cement Association.

On Wednesday, November 19 the morning session was devoted to the usual business session at which Committee reports were presented to the members, the annual election of officers concluding the session.

F. W. Kelley of Albany, New York, President of the Helderberg Cement Co., who has served as President of the Portland Cement Association for the past two years, was presented on retiring from office an engrossed testimonial signed by practically the entire membership of the Association and recording appreciation of the membership for his contribution to the advance of Association work during his administration.

The officers elected for the ensuing year were the following: Blaine S. Smith, Chicago, General Sales manager, Universal Portland Cement Co. was elected President; Lowell R. Burch, New York, Vice President, Atlas Portland Cement Co., was elected First Vice President of the Association and C. A. Irvin, Chicago, Vice President, Alpha Portland Cement Co., was elected Second Vice President. John W. Boardman, Detroit, Vice President of the Huron and Wyandotte Portland Cement Companies was reelected Treasurer.

Blaine S. Smith

In September a number of representatives of Portland Cement Association members journeyed to England to present to the City of Leeds, England, a bronze tablet as a tribute to Joseph Aspdin in commemoration of the patenting of Portland cement by him in 1824. While abroad many of these American manufacturers visited various cement plants in Great Britain and on the Continent and it was natural therefore that as a mark of courtesy, not to mention an equal interest in the cement centennial year, that a number of European cement manufacturers should visit this country to assist the Portland Cement Association in its centennial observance.

The afternoon session of Wednesday, November 19, was given over entirely to a special program in commemoration of the cement anniversary. Representatives of various professions related to or associated with the several branches of the construction industry presented short talks relating to the effect concrete has had in the advance of engineering, architecture and associated construction lines as coming under their

particular observation and practice. After the foreign and other guests had been given a few appropriate words of welcome by President Blaine S. Smith, F. W. Kelley acted as chairman of the session and opened it with the following centennial address:

"One hundred years ago Portland cement was patented in England by Joseph Aspdin. Of course, cements of one kind or another had been used for several thousand years, but with this discovery began a new era in the usefulness of cement. Leeds, the home of Joseph Aspdin, was also the home of John Smeaton, builder of the Eddystone Lighthouse, who made many experiment in discovering the reason for the hydraulic properties of cement. For seventy-five years the atmosphere of Leeds must have been surcharged with the elements of Aspdin's invention.

Aspdin, like most inventors, added to accumulated knowledge the necessary bits of new experience which accomplished a distinct forward step. He deserves and has received the credit and honor due men of vision and enterprise, on whom progress depends. He also had the foresight to adopt and protect a trade name of singular appropriateness and appeal, when he called his material Portland cement after the widely used building stone quarried in the Isle of Portland.

The early years of the 19th century witnessed many other important discoveries. These created new conditions which induced new inventions. These ceaseless adjustments and adaptations result in the complex and nicely adjusted relations we call civilization. As parts of the social organism, we each function in either a distinguished or undistinguished manner, to help or retard the net result.

The same one hundred years which witnessed the greatest progress in every line of human knowledge, effort and relations, saw Portland cement playing its full part in promoting progress, and the cement industry adjusting itself to changing needs. The crude manufacturing methods of Aspdin were improved and perfected by Isaac Johnson and later technical men. Portland cement with definite constituents and superior qualities, rapidly supplanted the existing natural products. Its manufacture soon spread to the Continent, later to the United States, and finally to all parts of the world, as chemistry and engineering overcame the difficulties presented by raw materials of widely varying chemical and physical characteristics.

We in this country should always hold in grateful memory the names of the pioneers who overcame the unique difficulties in the United States. Today a reliable product, assuring good results if properly used, can be obtained almost anywhere. This is substantial evidence of a century of endeavor. Portland cement is only potentially useful until it fulfills its destiny as an integral part of concrete. This transformation in which its inherent qualities are fully utilized and made permanently useful, involves knowledge and workmanship by the user.

Aspdin probably both made and used his first product. Others who employed early Portland cement had been trained through long apprenticeship in the traditions and experiences of generations of builders. The quantity of Portland cement was limited. Its early uses were few and simple. Then came a gradual realization of the wonderful adaptability and convenience of this plastic stone. Its field was widened by the added qualities conferred on concrete by metal reinforcement. The earliest attempts at adaptation which had followed closely the forms of the building materials supplanted, gave way to new designs in which the advantages of concrete were directly utilized.

Soon the engineer and trained builder who had aided in much of this development, no longer monopolized the design and application of the material. The handy-man, anybody who wanted permanent structures, tried Portland cement concrete. He got results. Others tried it. A thousand uses developed. It was easy to use, but also easy to abuse. A new need was clearly indicated. Obviously the utility of the product would be proportional to the number of satisfied users. All who desired to employ it must be informed how to use it rightly. Thus began a world wide program of research and education which in the United States has few parallels.

The kind of structures in which concrete could be most favorably employed, and the best way to make the concrete in each of these structures was tested in the field and studied in the laboratory. Fundamentals were

determined. Methods for making the information available were weighed and the indicated means were provided. The end of the first century of Portland cement finds us in this stage of development.

The public which by using concrete has made an estimated saving of $10,000,000,000 in its construction costs, wants to save more. It is convinced that for many uses concrete is supreme. The estimated world use of Portland cement is now at the rate of nearly 300,000,000 barrels per annum. Portland cement concrete is part of the fabric of our civilization.

This centennial is a mile-stone by which progress can be measured, and is a beacon casting its light on the path to the future. Our attention is directed to what needs to be done, as well as to what has been done. We who are privileged to make and use this wonderful material, have a duty to perform for ourselves and for posterity, in continuing unabated our efforts to apply all the resources of modern knowledge to perfect the making and use of our product.

"This anniversary is best celebrated; we best show respect for the memory of the distinguished and undistinguished workers who have developed this great industry through its first century, by resolving to do our bit in aiding the complete adjustment of the industry to the needs of the dawning century. We will also thus gain the satisfaction of playing a worthy, if perhaps undistinguished part in supplying a real service to society."

Following Mr. Kelley, papers were presented by A. N. Talbot, Professor, Theoretical and Applied Mechanics University of Illinois, Urbana, representing the American Society of Civil Engineers; Charles E. Fox, President, Illinois Society of Architects, Chicago, representing the American Institute of Architects; H. R. Safford, Vice President, Chicago, Burlington & Quincy R. R. Co., Chicago, representing the American Railway Engineering Association; P. H. Bates, Chief of Section, Structural Engineering and Miscellaneous Materials, representing the U. S. Bureau of Standards, Washington, D. C.; Richard L. Humphrey, Consulting Engineer, Philadelphia, representing the American Society for Testing Materials; A. E. Lindau, President the American Concrete Institute, Chicago, representing the American Concrete Institute and Edward N. Hines, Chairman of Board of County Road Commissioners of Wayne County (Detroit), representing Road Builders and Highway Officials. The unquestioned national prominence and respect which all of these participants command, brought forth, as was naturally to be expected, real contributions to the history of cement's first one hundred years.

Several of the foreign guests were also on the program, among them being: Gustave Deroover, Brussels, Belgium, President, Union des Cimenteries; President, Groupement professional des Fabricants de Ciment Portland Artificial de Belgique; Dr. Peter Hans Riepert, Charlottenburg, Germany, President, Deutscher Zement Bund; Charles Candlot, Paris, France, representative of French Portland Cement Industry; Poul Larsen, Copenhagen, President, Tunnel Portland Cement Co., England, Alborg Portland Cement Fabrik, etc., Denmark and A. Holter, Brevik, Norway, Director-Manager, Dalen Portland Cement Fabrik, each of whom gave from the viewpoint of his personal experience, a brief description of the cement industry and its growth in his native country.

The Department of Commerce announces that, according to the data collected at the biennial census of manufactures, 1923, the establishments engaged primarily in the manufacture of Portland, natural, puzzolan, and high-temperature cements in that year reported a total production valued at $285,050,551, an increase of 40 per cent as compared with $203,626,929 in 1921, the last preceding census year. The quantities and values of the principal products were as follows: Portland cement—137,460,238 barrels valued at $278,732,025, an average of $2.02 per barrel; natural and puzzolan cement—1,325,465 barrels valued at $2,061,894, an average of $1.55 per barrel. Of the establishments reporting, 23 were located in Pennsylvania, 4 in Michigan, 12 in New York, 9 in California, 8 in Kansas, 7 in Ohio, 6 in Alabama, 5 each in Illinois, Indiana, Iowa, Missouri and Texas, and the remaining in 15 other states.

F. A. Lotz & Co. of Philadelphia were recently incorporated for $5,000 to deal in cement, by Edward P. Bocklus.

Some 1923 Quarry Statistics

OPERATION of the stone quarries of the nation required the services of 92,455 men in 1923, a larger number than has been employed in this industry since 1915, states the Department of the Interior in a review of statistics compiled by the Bureau of Mines. A total of 25,545,859 shifts were worked, constituting an average of 276 work days per man. Accidents during the year killed 143 men and injured 14,990, indicating a fatality rate of 1.68 and an injury rate of 176 per thousand full-time, 300-day workers. The corresponding rates for 1922 were 1.92 killed and 172 injured; for the five-year period 1916-1920 similar rates were 2.10 killed and 160 injured.

The volume of work performed, or the aggregate number of man-shifts worked by all employees in 1923, has not been equalled in the stone quarrying industry since 1913, the Bureau of Mines statistics show. The average number of work days per man was the highest ever reported. The fatality rate from accidents at the quarries was the lowest on record. The nonfatal-injury rate was slightly higher than that for recent years.

In the number of man shifts worked, all branches of the quarry industry experienced a better year in 1923 than in 1922. As compared with 1922 lower fatality rates were indicated for quarries producing slate, granite, cement rock, and sandstone. The rates for limestone quarries and for traprock quarries were the same as in 1922, while the fatality rate for marble quarries, though lower than for most other kinds of quarries, was yet slightly higher than in 1922. The nonfatal-injury rates were lower for quarries producing limestone and traprock and higher for quarries producing cement rock, granite, sandstone and slate. The rate for marble quarries remained unchanged.

Men employed within the quarry pits numbered 57,188; they averaged 263 work days per man during the year and performed a total of 15,067,691 days of work. Accidents to these men resulted in 99 deaths and 8,946 injuries, indicating a fatality rate of 1.97 and an injury rate of 178 per thousand full-time workers. Employees at crushers and other plants outside the quarries numbered 35,267; these men worked 10,478,168 shifts, an average of 297 work days per man. Accidents to these workers caused 44 deaths and 6,044 injuries, representing a fatality rate of 1.26 and an injury rate of 173 per thousand full-time workers.

The accident rates for men working inside quarries producing building or monumental stone were 1.15 fatalities and 144 injuries per thousand full-year workers, as compared with 1.94 killed and 140 injured in the previous year; the rates for crushed-stone quarries were 2.21 killed and 187 injured, as compared with 2.50 killed and 190 injured in 1922.

At the outside rock-dressing plants of the building-stone quarries the rates were 0.28 killed and 199 injured, as compared with 0.77 killed and 187 injured in the previous year; at crushers, cement mills, etc., the rates were 1.60 killed and 172 injured, as compared with rates of 1.56 killed and 162 injured in the year 1922.

Of the 15,133 accidents reported by the entire quarry industry during the past year, 143 (0.95 per cent) caused death, 12 (0.08 per cent) caused permanent total disability, 431 (2.85 per cent) caused permanent total disability, 2,567 (16.96 per cent) resulted in temporary disability lasting more than 14 days, and 11,980 (79.16 per cent) resulted in temporary disability exceeding the remainder of the day or shift but not exceeding 14 days.

The main causes of accidents inside the quarries were handling rock at the face, flying objects, haulage, falls or slides of rock or overburden, machinery, falling objects, falls of persons and drilling and channelling, in the order stated. Accidents outside the quarries were due mainly to flying objects, machinery, falling objects, haulage, falls of persons, and hand tools. The principal causes of accidents resulting in death to employees inside the quarries were falls or slides of rock or overburden, haulage, explosives, and falls of persons, while accidents resulting fatally to the employees at the outside pants were due mainly to machinery, haulage, falling objects, falls of persons and burns.

Zelnicker Bulletin No. 330

The latest Zelnicker equipment stock-list features *Switches—Two Unusual Offerings in a Super-Useful Size,* with illustrations.

Cost Accounting in the Crushed Stone Industry

VI

Written expressly for PIT AND QUARRY by D. J. HUTCHINSON

This article concludes the series on the subject of Cost Accounting in the Crushed Stone Industry by Mr. Hutchinson. The first of these articles appeared in the September number of PIT AND QUARRY.

The subjects considered in this series include:

1. Cost Accounting and Selling Prices.
2. The Application of Uniform Methods.
3. The Elimination of Costs.
4. General Classification of Expense Accounts.
5. Natural Classification of Expense Accounts.
6. Departmental Classification of Expense Accounts.
7. The Chart of Expense Accounts.
8. Principles of Expense Distribution.
9. Distribution of Departmental Expense.
10. Distribution of Fixed Charges.
11. Indirect Operating Departments.
12. General Plant Departments.
13. Labor Distribution.
14. Cost Accounting and General Accounting.
15. Depletion, Depreciation and Other Special Problems.

An adequate cost system is essential to crushed stone producers, and these articles can be the means of effecting such a system. Readers having particular questions relating to costs may address Mr. Hutchinson, care PIT AND QUARRY. EDITOR.

ONE of the important items entering into the cost of production of crushed stone is depletion. We have reserved for separate consideration the methods of determining this item owing to the somewhat complex nature of the problems involved.

The theory of depletion is simple. It is merely a recognition of the fact that natural resources become exhausted, and that some provision must be made for the return of the capital invested in them. The principle also is simple that such provision should be made by a current charge to production offset by a reserve for depletion and calculated at a rate that will bring the reserve up to the value of the property by the time the later shall have been totally exhausted.

But the application of this principle in establishing the amount of the current charge gives rise to practical difficulties of no small proportions. Obviously four facts are required as a basis for such calculation:

(a) the value of the property to be depleted

(b) the estimated yield or total contents of the property measured in terms of the usual units of output (cubic yards)

(c) the unit value of the product

(d) the rate of production

Given these facts, the calculation is a simple problem in division and multiplication. There is little difficulty in establishing the last of the four facts required. It is found in the current production records, and the third fact follows from the first two $\frac{a}{b} = c$. But the determination of (a) and (b) is not so simple due largely to the difficulty of locating the data on the basis of which these facts can be supported.

The first fact to be established is the value of the property to be depleted, as of the basic date. This date, due to the requirements of the income tax laws, is March 1, 1913, in the case of properties acquired prior to that date, or the date of acquisition if subsequent to March 1, 1913, and the value is the fair market value, which is defined as "that amount which will induce a willing seller to sell and a willing buyer to buy."

In the case of properties acquired after March 1, 1913, there is usually a record of the purchase price which establishes the value of the property as of the date of acquisition. In cases where in addition to the quarry site the purchase price included improvements in the way of plant, machinery, etc., the latter must, of course, be excluded in determining the depletable value. If this condition exists and the

records of the transaction do not show any division of the total price as between quarry site and improvements, it may be necessary to establish the value of each by retrospective appraisal.

Obviously where depreciation on the improvements is taken as a distinct item of operating expense, which is the procedure followed in the previous pages, the value of the improvements can not also be included in determining the value of the property to be depleted, as this will result in a double charge. It is true that in many industries based on the development of natural resources, the value of the improvements is included with the value of the resources and depletion applied to both. This is a justifiable procedure where the life of the improvements is expected to be at least as great as the life of the resources. This is not the condition in the average stone quarry, however, where the greater part of the plant investment will be renewed many times during the life of the pit. The value for depletion purposes is, therefore, the value of the quarry site only.

Properties acquired prior to March 1, 1913, must be revalued on the basis of the remaining contents or estimated future yield as of that date. Usually such valuation will include a large amount of appreciation, particularly if depletion has been charged at an adequate rate during the preceding years. This appreciation is put on the books by increasing the property account and crediting the amount of such increase to a special surplus account, designated as "surplus arising from appreciation of assets," or some similar term. It is important to keep surplus created in this manner entirely distinct from surplus arising from earnings.

The method of establishing the March 1, 1913, value varies with the circumstances of each individual case, and about the only general rule that can be laid down is that any evidence which tends to indicate or support the value as of that date should be employed. Several methods are recognized for establishing such valuations, some applicable under certain conditions, and others under other conditions. Where two or more methods can be employed, each serving to substantiate the results obtained by the other, the valuation has that much more weight.

The simplest and most direct method is by comparison with other properties similarly situated and presumably of like value where the values have been established by sale or transfer at or about the basic date. The difficulty with this method is to locate the comparatives. Profitable quarry properties do not change hands often. In the absence of such comparatives collateral evidence tending in the same direction may be employed, such as a bona fide offer of purchase or sale, even where the transaction was not finally consummated, particularly if it can be shown that the failure to negotiate was due to factors other than price. Or the same data may be calculated from royalties established for similar properties. Finally, the "present value" method may be resorted to, which is based on capitalization of anticipated future earnings, before deducting depletion, by the customary annuity calculations. In applying this method, however, it must be kept in mind that the "anticipated future earnings" as of the basic date, are those that could be expected under the conditions existing at that date, and from the information then obtainable, rather than earnings based on conditions and information available at the later date when the calculation is made. For example, higher earnings based on increased prices and decreased operating costs developed in the intervening years can not be used as a basis for a retrospective determination of valuation. Such valuation must be based on the earnings that could reasonably have been anticipated in the light of the prices and costs prevailing at the date as of which the valuation is made. The methods discussed above indicate the difficulties inherent in establishing the fair market value, particularly where there is no actual transfer of the property or of other properties similarly situated by which "that amount which will induce a willing seller to sell and a willing buyer to buy" may be determined.

Almost as difficult to establish is the extent or probable yield of the property measured in the usual units of product, which in the case of crushed stone is cubic yards. No one can tell exactly what will come out of a hole in the ground, even estimating it from immediate survey or examination, and where the survey must be retrospective to the basic date, the problem is even more difficult, particularly where there are no adequate

records of production during the intervening period. We are again obliged to base a conclusion on the best estimate that can be made, supported by whatever data can be obtained.

In making this estimate, the question of availability is of first importance. There are certain natural resources, for example, timber, where the limit of the total supply is in sight. This is not the case with crushed stone. Probably a large proportion of the total area of the country is underlaid with material suitable for crushed stone, so that, strictly speaking, there is no limit to the supply. Not all of this supply, however, is available for commercial purposes under present competitive conditions. Availability refers not only to the physical characteristics of the terrain or the "lay of the land." It refers also to proximity to transportation and to markets. Considering these factors, there is a very definite limit to the extent or expected yield of a stone property. Moreover, the mere fact that a property has been once opened up gives it an advantage and, therefore, a value over a similar site which is entirely undeveloped, and the available supply on a given site is distinctly limited, keeping in mind that this supply does not mean the total contents, but only that portion that can be gotten out on a competitive basis. But these again are matters that must be determined with respect to each individual property.

Before leaving the question of valuations for depletion purposes, it should be pointed out that under certain circumstances depletion is from the income tax standpoint an allowable deduction to the operator under a leasehold as well as to the one operating a site that is owned in fee. Ordinarily the operator on a lease or royalty basis has no interest in the property itself. He has only certain rights to use the property, for which he pays, and the depletion accrues to the lessor. However, leaseholds are in form of property, and when they have been acquired prior to March 1, 1913, they may be revalued as of that date, and depletion taken by the lessee on such valuation. The value of the leasehold in such case is determined by methods similar to those applied to the determination of the value of a freehold.

The determination of a proper depletion charge is an important problem from the standpoint of income taxation, not only in its effect on the true income of the corporation, but from the stockholder's point of view as well. He should know what part of the dividend he receives represents true earnings, and what part a return of capital through the exhaustion of the property for which insufficient provision is being made. The problem is, therefore, one requiring careful analysis with respect to the peculiar circumstances surrounding each individual property.

In fact, the greater part of the problems of cost accounting in the crushed stone industry are individual problems. As we pointed out in the first article, the fundamental factor determining cost accounting methods is the operating conditions in the industry and in the individual plant. The necessity of this appears from the very purpose of cost accounting which is to reflect the results of operations, and where the operations are unique the interpretation of them in the cost records must be made to conform. The extent to which uniform cost accounting methods are applicable within any industry is the extent of uniformity in operating problems and operating practice.

In the crushed stone industry we have in general the same problem throughout,—that of getting stone out of the ground, preparing it for use and shipping or delivering it to the user. In its general operations also the industry follows as a whole substantially the same procedure, first stripping the ground, then blasting the stone and removing it from the quarry, crushing it and finally the shipping or delivery of the product. But the uniformity of practice does not go a great deal further. Hence we have been able in these articles to offer only the accounting principles by means of which the major operations of crushed stone production can be analyzed and the costs of each determined. The same principles can be applied to the more detailed operations but these vary so widely throughout that the application of cost accounting methods to the detail operation is necessarily a matter largely of individual effort.

We have endeavored to show how the expenses incurred in the course of production may be accumulated and applied to determine the cost of the product in terms of the operating

processes involved. The question remains as to whether when this is accomplished we have actually determined the true cost of production which we may use as a basis for fixing the price of our commodity with confidence that it will yield a profit.

We started from the premise that the cost of production consists of the labor, material and expense employed. If all of these expenditures are included in the final figures, we have, if our premise is correct, arrived at the true cost of production, and by the use of controlling accounts tying the cost records into the general financial accounts, we have insured the inclusion of every expenditure. The question then becomes one of whether the total of the labor, material and expense employed actually constitutes the total cost of production.

From the strict monetary standpoint it must seem that they do, since every dollar exchanged for production expense has been charged to production cost. But the cost of production in the broadest meaning of the term must include more than the day by day expenses of operation. This will appear if we consider again the connection between price and the cost of production discussed at the begin ning of these articles. There it was pointed out that price is determined in the last analysis by the cost of production, and that it necessarily follows that a knowledge of the cost of production is the first requisite to an adequate price policy. Now such a price policy must establish a ratio between cost and price that will yield an average profit over long periods of time, but this ratio is not determined by the relation of current costs to current prices.

As a practical business matter, periods of low prices are not usually periods of low cost nor vice versa. The reason is found in the invariable overhead costs which do not fluctuate with the volume of production. Hence low production which is usually accompanied by low prices is also as a rule accompanied by high costs. The situation often arises where the product must be disposed of at less than cost, or at least at a greatly reduced profit, in order to meet a part of the fixed charges. These losses must be recovered by adding a corresponding amount to the price over the actual cost and usual profit when conditions will permit.

These are problems of management and business judgment, rather than of cost accounting. But it must be kept in mind that the cost of production as determined from the cost records must for the purposes of price determination be adjusted to compensate for the inequalities arising from a fluctuating volume of business, if operations are to be on a profitable basis over the long haul.

Hutchinson Opens Office

Mr. D. J. Hutchinson the author of the series of articles on Cost Accounting which have been appearing in PIT AND QUARRY has organized D. J. Hutchinson and Company with offices in the Chicago Temple Building, Chicago.

The company will specialize in problems relative to cost methods, taxes, audits, and appraisals. Mr. Hutchinson will personally devote a large portion of his time to these problems as they relate to the crushed stone and the sand and gravel industries.

New Kuhlman Appointees

The Kuhlman Electric Company of Bay City, Michigan, has appointed Howard J. Wittman, 632 Nasby Building, Toledo, Ohio, as District Representative. Mr. Wittman will have Northwestern Ohio as his territory.

This company has appointed The Globe Electric Supply Company, 1843 Wazee Street, Denver, Col., as District Representative. The territory involved includes the states of Wyoming, Colorado and New Mexico. The Kuhlman Company expects to have a stock of Transformers placed shortly with this new representative.

Loomis Bulletin "CR-44"

Bulletin "CR-44," on the Loomis "Clipper" Blast Hole Drill, has been issued by The Loomis Machine Co., Tiffin, Ohio. It describes this new model drill, which is mounted on Crawler Tractor Wheels, and is designed for the use of Contractors, Quarries, Ore Bodies, Stone, Lime and Gypsum Plants, Coal and Slate Stripping, Mine Ventilation, Railroad Cuts, and Dewatering Holes.

A Big Cement Winter Ahead

Shipments the Past Month Have Duplicated the High Record of September. Many Company Developments Under Way

By Our Special Correspondent

THE TURN of November shows encouraging conditions for the winter months ahead among the cement mills in the Lehigh Valley district of Pennsylvania, and all of the leading plants continue under maximum activities. Marked impetus has been given both to production and distribution as a result of the presidential election, and the volume of business now ensuing is not only heavy for current account for this time of the year, but is keenly alive with respect to future deliveries. A number of the mills are booked for weeks ahead, and it now becomes a question when different operating departments may be temporarily curtailed for necessary repairs to machinery and equipment.

Contracting interests throughout the eastern distributing centers are putting out numerous inquiries for early cement deliveries, indicating that an active winter season is at hand for the producers. Building supply dealers, also, are calling for hundreds of barrels of material, and this branch of trade shows every inclination to hold up stocks in anticipation of immediate consumer demand. Highway construction, likewise, looms as a primary factor of consumption in the weeks to come, and it is currently stated that orders for this account for spring work will be placed unusually early, and will be unusually heavy.

Shipments from the mills throughout Lehigh territory during October have been duplicating the high record of September, and November distribution is going forward at the same pace. In a word, the material is being shipped as fast as it is manufactured. The recent government reports showing a record-breaking year in the use of cement, and the Geological Survey figures of a gross production of 110,463,000 barrels during the first nine months of the present year, go to indicate the heavy output of the Lehigh Valley mills, which comprise one of the important producing centers of the country.

The Geological Survey compilations in connection with gross shipments, showing an amount of 112,792,000 barrels during these nine months, also tell of the vast distribution from the Pennsylvania mills. The railroads are holding up well in furnishing necessary cars, and motor trucks are being pressed into the same active service for distribution as in the months past. The season has been distinctly favorable up to the present time for motor truck haulage, and with a continuance of open weather will maintain indefinitely. Additional trucks are being provided for the different fleets to assist in prompt distribution.

Despite the keen desire of producers to accumulate stocks in storage, there has been little or no opportunity in this direction, and for the most part stock houses remain bare. This situation will prevail, in all likelihood, for a number of weeks to come, or well into the holiday season, when a little lull may be possible. Packing departments are particularly active, with overtime prevailing at a number of the mills.

The labor situation shows no change except in the line of lessened supply of available men. Practically every mill is giving employment to a normal working quota under regular and overtime schedules, and "coaters" are not in any marked prominence at the present time, owing to the reopening of other plants in different lines of industry in this district. Wage schedules show no change and the condition in this connection is satisfactory.

Mills on the active list, working at peak schedules, include the Lehigh Portland Cement Co. at Ormrod, (Mill No. 3), Fogelsville and West Coplay; the Coplay Cement Mfg. Co., Coplay; the Giant Portland Cement Co., Egypt; the Hercules Cement Corporation, Hercules; Bath Portland Cement Co., Bath; and the Alpha Portland Cement Co., Martins Creek. Likewise, the Atlas Portland Cement Co. is particularly busy at its large mill at Northampton, with employment of maximum working force, and the company is said to have orders ahead for many weeks to come at the present schedule. The Whitefall Portland Cement Mfg. Co. is maintaining full production at its mill at Cementon, with no indication of any let-up. The Pennsylvania Cement Co. is running full at its Bath mill with an encouraging volume of business booked. The Crescent Portland Cement Co. is another active interest in this district, and its Crescentdale mill is giving employment to a full oper-

ating force under peak production schedule.

The Virginia Portland Cement Corporation, Norfolk, Va., recently organized by officials of the International Cement Corporation, New York, as a subsidiary interest is arranging to proceed with the immediate construction of its proposed mill in this section, utilizing the site of a former plant lately purchased. A contract has been awarded to Baker & Brinkley, Norfolk, for the construction of two new buildings at the foot of Ohio Street, each two-story, estimated to cost in excess of $40,000. Work will be placed under way immediately on a one-story machine shop, 72x160 ft. Plans for the main mill, including power house, storage buildings and other miscellaneous structures, have been completed, and a list of machinery and equipment to be installed is being arranged. The entire plant is estimated to cost in excess of $1,200,000, and is expected to be ready for operation about the middle of the coming year. This will make the eighth plant of the parent organization, which was formed in 1919 to take over five existing mills with a rated gross output of 2,800,000 barrels per annum. Since that time the company will have added three mills to this quota with the completion of the Norfolk works, developing a capacity of 7,000,000 barrels, yearly. The sales for the present year have aggregated close to 6,000,000 barrels of material.

The Linwood Cement Co., 713 Kahl Building, Davenport, Ia., John F. Schroeder, secretary, has authorized plans for the construction of a new cement mill on site selected about 8 miles from the city, near the right-of-way of the Chicago, Rock Island & Pacific Railroad. The plant will consist of a number of buildings, including main mill, stockhouses, bagging mill, power plant, machine shop, and auxiliary structures, and will operate under the wet process. The initial works will have a rated output of approximately 1,000,000 barrels per annum, and are estimated to cost close to $1,800,000. Plans are being drawn by the J. C. Buckbee Co., 38 South Dearborn Street, Chicago, Ill., engineer, and it is understood that bids will be asked for erection at an early date.

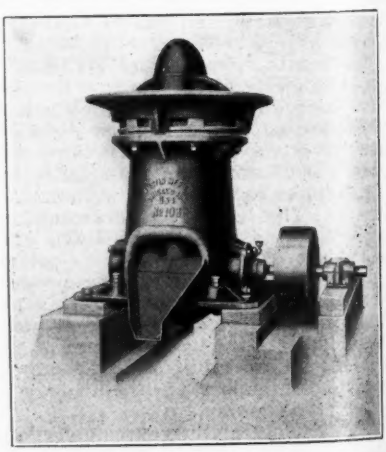
The Signal Mountain Portland Cement Co., James Building, Chattanooga, Tenn., has preliminary plans under way for the construction of a new addition to its plant, comprising a third mill unit. It is proposed to have the structure ready for service late next spring. The unit has been designed to advance the plant output to 4,000 barrels a day, and is reported to be estimated to cost in excess of $500,000.

The San Antonio Portland Cement Co., San Antonio, Tex., will make a number of improvements in its plant for general increase in output, estimated to cost close to $80,000. Contract has been let for the construction of 10 reinforced-concrete slurry tanks, for which plans were drawn by the W. E. Simpson Co., National Bank of Commerce Building, engineer.

Austin's Super Gyratory

The Austin Manufacturing Company of Chicago has issued circular 18-A on its new No. 103 Austin Super Gyratory Crusher. This crusher is designed for making a fine product, and differs from the ordinary gyratory crusher in that the shaft and eccentric are made extremely large to stand the great strain of fine crushing.

This crusher is built especially for crushing extremely hard rock and gravel, and is approximately the same size as the Standard No. 3 Austin Gyratory, fitting on the same foundation and being the same height. The countershaft is supported by two renewable bronze bushed bearings and can be inserted in any one of the three sides of the crusher. The lubrication of the eccentric is accomplished by splash feed.



The Austin "Super"

Healthy Call for Sand, Gravel

Steady Advance in Building Projects in New York and Northern New Jersey. Prospects Good for Winter Season

By Our Eastern Correspondent

THE SAND, gravel and crushed stone markets at New York and other important points in the eastern district reflect the results of the presidential election in a marked degree. The general prosperity and trade awakening in different branches of the construction field utilizing these basic materials since this event, seem destined to make for large output and heavy distribution in the weeks to come. Weather conditions, also, are highly favorable at the present time to production, and leading producers in the Long Island and New Jersey districts are making the most of the situation. Massachusetts and Connecticut plants, likewise, report good activity in this respect.

Each week in November has shown an advance in contemplated building projects in the New York and Northern New Jersey territory. From 300 to 400 projects of various kinds are being made public weekly, with call on contractors for figures. The estimated outlay of this forthcoming work ranges from $25,000,000 to $30 000,000 weekly, with residential structures and housing development comprising the bulk of work; next in line are business buildings, followed by public structures. Industrial construction is still at rather a low ebb, although prospects in this direction are decidedly encouraging, and a marked advance is anticipated after the turn of the year.

The labor situation in this district holds uniform. With current operations the supply is entirely equal to the demand, and in some lines men are readily available on short call. The wage situation continues satisfactory and there are no current dissensions worthy of note.

There is a healthy call for sand, gravel and crushed stone stocks in this vicinity. While contracting interests lead in point of demand, building supply dealers show no hesitancy in stocking up in anticipation of a continuance of call, coupled with the expected forward movement in line of consumption. Prices are firm, with indication of higher levels in certain directions; this, already has occurred in connection with gravel at New York as well as at Boston, with the latter district also showing an advance in crushed stone. Corresponding changes seem likely to ensue in other materials in this line in the eastern distributing centers. Portland cement maintains at established levels and mills, evidently, are seeking to hold at present attractive figures to encourage consumption during the winter months.

Best washed gravel in the New York market, wholesale, is now quoted at $2.00 a cubic yard, in cargo lots, as compared with $1.75 prevailing for a number of months past; the new rate applies both to 1½-in. and ¾-in. stocks. There is a considerable turnover for the present season of the year and sizable quantities of material are reaching the local market. Current account shows a growing tendency and orders for future deliveries are encouraging. Building supply yards continue to quote at $2.75 per cubic yard for material of both sizes, delivered on the job; it is currently reported that an advance will be made in this figure at an early date for retail consumption to correspond with the increased wholesale level.

Good washed sand maintains at a $1.00 per cubic yard figure, carload lots, wholesale. This is a reduction of 25 cents in the quotation at this time a year ago, and there are indications that an increase may prevail in the early weeks to come; producers hold to the opinion that a more consistent profit is warranted in connection with current production costs. Retailers are asking $2.00 per cubic yard for stock delivered to site within established zones, with slightly increased figures for longer hauls.

Crushed stone continues at $1.75 per cubic yard for 1½-in. sizes, and $1.85 for ¾-in. stock, wholesale account, cargo shipment. These current levels are decidedly firm, with indication of an upward trend. While there has been a slight decrease in call, owing primarily to the completion of different highway projects, inquiries for early future deliveries show that the material will enjoy heavy distribution shortly after the turn of the year. Building supply dealers are quoting $3.00 for crushed stone, both standard sizes, delivered on the job, and report a fair call at the present time.

Portland cement is operating under good demand in the New York district, and heavy shipments from the Lehigh Valley and Northern New York mills are rapidly consumed.

Building supply yards are prominent in point of call and many carload orders are reaching this quarter for retail distribution. The supply yards, as well as contracting interests, continue to pay $2.15 per barrel for the material alongside dock, while delivered stock, wholesale, is quoted at $2.55 and $2.60, carload lots, without bags; these figures are subject to a cash discount, and correspond with levels of $2.30, alongside dock, and $2.75, delivered, at this same time a year ago. In the retail market, $3.00 a barrel continues as the established quotation, delivered on the job, within the different zones, subject to the bag rebate of 10 cents each. The mill base at Hudson, N. Y., is now at $2.05, cargo lots, while in the Lehigh Valley district the mills are holding to the established rate of $1.95.

There is fair activity in the New England markets in the line of building commodities, with sand, gravel and crushed stone engaging under good distribution. Crushed stone has advanced from $1.50 and $1.55 a ton, 1½ and ¾-in. sizes, to $1.60 a ton, wholesale, and is firm at the new figure. Good washed gravel has increased to $1.50 a ton, both 1½ and ¾-in. sizes, as compared with previous levels of $1.40 and $1.45. As in the case of crushed stone, the new quotations are well defined and established with contractors and dealers. Washed sand continues at $1.00 a ton, wholesale, cargo shipments; a year ago, the last noted material was selling for $1.10, and a return to this latter level would not be entirely unexpected. Portland cement is being turned at $2.70 a barrel in carload lots in this section, wholesale, while building supply dealers continue to quote at $3.40 a barrel in truck load orders, and $3.48 a barrel in less than this amount. White cement is being retailed at $2.00 a barrel. These different quotations are those prevailing in the Boston market and are quite typical of the different important New England distributing centers.

The A. V. Kozak Co., 592 North Main Street, Wilkes-Barre, Pa., operating a stone and granite works, has arranged for immediate expansion in its plant, and will break ground for two new buildings on East Union Street, estimated to cost approximately $46,000, including equipment. The company reports a good volume of business at the present time, and the new structures have been designed to provide for considerable increase in plant facilities in anticipation of advancing orders.

Stone quarries in Eastern Pennsylvania are operating under good output for the present season of the year, and leading producers are making the most of the favorable weather to create reserve stocks for future account; up to the present time the volume of call for current demand has curtailed stocking up, particularly true in the vicinity of Birdsboro, Norristown and in the Allentown district, where highway construction has been calling for peak outputs.

Bucyrus General Catalog

"Would you plow with only one handle to guide and steady your plow," enquires the Bucyrus Company of Milwaukee, in its new General Catalog, "or in the well-tried, century-old manner with two handles, spread well apart, to steady your plow and make your work easier? If this is true with a plow—why not with a steam shovel?"

The Bucyrus Outside type of dipper handle gives such a connection, making possible a box-section boom with no split down the middle, "the strongest possible construction to withstand the heavy twisting strains of digging." This is one reason, they say, why the Bucyrus is one of the fastest and strongest small revolving shovels built.

The catalog, which is profusely illustrated with views of the Bucyrus at work, describes briefly the products of the Bucyrus Company. The subjects treated are: Small Revolving Shovels—steam, Diesel, electric and gasoline; Large Revolving Shovels—steam and electric; Dragline Excavators—steam, electric, Diesel electric, Diesel and gasoline; Railroad Type Shovels—steam and electric; Caterpillar Mounting for Railroad Type Shovels; Clamshell Excavators and Cranes—steam, Diesel, electric, and gasoline; Sewer Excavators—steam, Diesel, electric and gasoline; Tower Excavators — steam, electric and Diesel electric; Hydraulic or Suction Dredges—steam, electric and Diesel electric; Elevator Dredges—steam, electric, and Diesel-electric; Alluvial Mining Dredge—steam, electric and Diesel-electric; Spreader Plows; Unloading and Ballast Plows; Railway Cranes; and Supplies and Special Equipment.